EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-01

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2012	Optimization Model for Reducin
	Base X Option Period Number	

Contractor: ICF INCORPORATED, L.L.C.

Specify Section and paragraph of Contract SOW: Task 2f

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 02/06/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 02/01/2012 To 09/30/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Ari Kahan (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4260 FAX Number:
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name: Jose Ortiz (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2831 FAX Number: 513-487-2109
Contracting Official Name: Sandra Savage (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2046 FAX Number:

STATEMENT OF WORK EPA Contract: ICF EP-C-12-011

WORK ASSIGNMENT 0-01

A. Issuing Office:	Environmental Protection Agency 2000 Traverwood Dr. Ann Arbor, Michigan 48105
B. Contractor:	ICF International 9300 Lee Highway Fairfax, VA 22031-1207
C. Statement of Work:	Optimization Model for reducing Emissions of Greenhouse gases from Automobiles (OMEGA)

BACKGROUND

As part of the Office of Air and Radiation, EPA's Office of Transportation and Air Quality (OTAQ) administers portions of Title II of the Clean Air Act, as amended in 1977 and 1990. Within OTAQ, the Assessment and Standards Division (ASD) does a wide range of work in support of EPA's efforts in air quality analysis. These efforts include creating and revising emissions estimation models and other tools, developing regulatory impact analyses, testing vehicles, supporting the vehicle inspection and maintenance programs, and other related projects.

Onroad vehicles represent the largest portion of the nation's petroleum consumption and a very significant portion of the nation's total fossil fuel consumption. As such, onroad vehicles are significant contributors to the nation's greenhouse gas (GHG) emission inventory. Reducing these emissions will likely be a necessary part of any program aimed at controlling the nation's total contribution to global warming. The Clean Air Act specifies that determining an appropriate level of control of these emissions requires an accurate assessment and consideration of both the costs and benefits and due consideration of the leadtime necessary to implement such emission controls and their incorporation into the onroad vehicle fleet. The wide variety of onroad vehicles and the range of available emission control technologies necessitate that any such assessments must be automated.

The current version of EPA's Optimization Model for reducing Emissions of Greenhouse gases from Automobiles (OMEGA) was developed under several work assignments in the EP-C-06-094 contract. The current model provides a broad set of calculations to support the reduction of on-road GHG emissions as described above. The model analyzes vehicle technology cost and effectiveness, as well as the benefits and impacts of potential programs.

PURPOSE OF THE WORK ASSIGNMENT / TASKS

The purpose of this work assignment is to fix elements of the current version of OMEGA that are not working as intended, to improve the operation of the core model, to further develop the input and output files, to update the Programmer Guide, and to integrate the OMEGA consumer choice module. The Contractor shall design, develop and test the model with the new capabilities in the tasks outlined below.

Task 1: The contractor shall modify OMEGA so that the program can model relevant mobile source GHG regulations. This may include adding additional program features in order to reflect draft regulations. The contractor shall update the core model code as provided in written technical directives by EPA's Work Assignment Manager (WAM) to properly account for technology cost and effectiveness calculations. This may include modifying core algorithms of the model, the methodology used to apply technology, integrating additional modules, or other changes. The contractor shall fix any program bugs as needed.

Task 2: The contractor shall continue to improve the layout, structure, and content of the input and output files with written technical direction from EPA's WAM.

Task 3: The contractor shall update the Programmer Guide to include a full description of the layout of the program, including definitions of the objects, and how data gets transferred between different parts of the program code. The contractor shall provide additional model documentation as requested in written technical directives by the EPA WAM.

Task 4: The contractor shall modify the program interface as provided in written technical directives by the EPA WAM.

Task 5: The contractor shall develop an iterative automated interface between OMEGA and the OMEGA consumer choice module under written technical direction from EPA's WAM. This may include modifying the OMEGA model, the OMEGA consumer choice module, or integrating the models. The contractor shall make other maintenance, bug fix, and feature changes to the OMEGA consumer choice model as provided in written technical directives by EPA's WAM.

OTHER TERMS AND CONDITIONS

Confidentiality:

The Contractor shall not divulge any information acquired in the course of the work assignment with respect to data, output, EPA file structures, data processing activities or functions, user ID, passwords or any other knowledge that may be gained in the course of this work, to anyone who is not authorized by EPA to have access to such information. Also, due to the sensitive and sometimes confidential nature of the information processed, Contractor personnel shall sign appropriate confidentiality agreement forms, and shall be briefed as to which information requires special handling.

Non-Disclosure Agreement:

All documentation and work product provided by EPA or generated as a result of this project shall be under the control of the Assistant Administrator for Air and Radiation, or his or her designated representative, and shall not be released by the Contractor to any other source without specific approval by US EPA.

D. Deliverables:

All deliverables shall be accurate and of professional quality and shall meet the requirements set forth in this WA/SOW and in the specific description of their attachments. The contractor shall work within the framework of this SOW, and shall comply with its requirements. The Contractor shall provide all source code and data tables used to develop specific applications. All products developed under this WA/SOW are the property of the US Environmental Protection Agency.

1. Quality Assurance Project Plan (QAPP)

2. Weekly meetings or email updates with EPA WAM, as needed, to discuss WA tasks and progress.

3. The Contractor shall continue to provide EPA with a running-and-under-development version of the model. EPA expects that modifications to the model may occur on a bi-weekly or monthly basis. The contractor shall provide EPA with updated versions of the model after each task has been completed. EPA will continue to own the OMEGA model.

4. The tasks shall be delivered to EPA WAM along with an updated version of the model including updated versions of the following, as necessary: Test documents and test results, the source code, executable applications/programs, and the instructions/mechanism for compiling the source code files and generating executables.

5. At the end of the performance period, the Contractor shall provide EPA WAM with an updated version of the model including a Programmer Guide, test documents and test results, the source code, executable applications/programs, any specialized testing suite used to

validate/error check the software, and the instructions/mechanism for compiling the source code files and generating executables.

E. Task Completion: Each Thursday of the work period the contractor shall report the percentage of the level of effort expended, percent of the task completed to date and any problems to the Project Officer, or alternatively to the Work Assignment Manager, via telephone or email. On the Thursday following the close of each biweekly accounting period, the percent of level of effort shall be based on the results of such accounting. On alternate Thursdays, a reasonably accurate estimate shall suffice.

F. COTRs and Project Officer: The Work Assignment Manager will be

Ari Kahan,
(734) 214-4260
kahan.ari@epa.gov

Alternate WAM

Jeff Cherry
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Cherry.jeff@epa.gov

The Project Officer will be

Greg Janssen
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EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-02

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2012	Uncertainty Analysis of Biofue
	Base X Option Period Number	

Contractor: ICF INCORPORATED, L.L.C.

Specify Section and paragraph of Contract SOW: Tasks 7 and 9

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 02/01/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
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Authorized Work Assignment Ceiling

Contract Period: 02/01/2012 To 09/30/2012 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Aaron Levy (Signature) (Date)	Branch/Mail Code: Phone Number: 202-564-2993 FAX Number:
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name: Jose Ortiz (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2831 FAX Number: 513-487-2109
Contracting Official Name: Angela Lower (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2036 FAX Number:

WORK ASSIGNMENT

Title: Uncertainty Analysis of Biofuel Lifecycle GHG Emissions

Contractor: ICF **Contract No.:** EP-C-12-011

Work Assignment Number: 0-02

Estimated Period of Performance: 4/2/12 to 9/30/12

Estimated Level of Effort: 492 hours

Key EPA Personnel:

Contracting Officer (CO):
Sandra Savage
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Cincinnati, OH 45268
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Project Officer (PO):
Greg Janssen
EPA/OAR/OTAQ/ASD
Phone: (734) 214-4285
Email: janssen.greg@epa.gov

Work Assignment Contracting Officer's Representative (WA COR):

Aaron Levy
EPA /OAR / OTAQ / TCD
Phone: (202) 564-2993
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Alternate WA COR:
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I. Background and Purpose:

Pursuant to its responsibilities under the Energy Independence and Security Act of 2007 (EISA), Renewable Fuels Program (RFS) provisions, EPA undertook a lifecycle assessment of the greenhouse gas emissions associated with different types of renewable fuel. As directed by

EISA, this analysis addresses the full fuel lifecycle of biofuels, including all stages of production, distribution and consumption. A key piece of the analysis, as directed by EISA, is inclusion of significant indirect effects, such as indirect land use change impacts associated with producing biofuel feedstock. EPA's approach has been to use the best tools and models available to estimate GHG emissions related to each component of the fuel lifecycle.

While EPA believes the lifecycle methodology developed for the RFS2 final rulemaking (FRM) represents a robust and scientifically credible approach, EPA recognizes that some calculations of GHG emissions are relatively straightforward, while others are associated with more uncertainty. EPA has previously worked with the Contractor to develop a stochastic spreadsheet model to quantify key areas of uncertainty related to indirect land use change GHG emissions. In previous work with EPA, the Contractor also submitted a Draft Research Plan to Quantify Uncertainty in Key Economic Models used in Lifecycle GHG Analysis. For this work assignment, the Contractor shall continue to operate and update the stochastic spreadsheet model used by EPA. Additionally, the Contractor shall continue to develop a research plan to quantify uncertainties in key economic models used in biofuel lifecycle analysis. This shall include designing a scenario analysis methodology to evaluate uncertainties.

II. CONTRACT LEVEL PERFOMANCE WORK STATEMENT REFERENCE

The tasks to be performed under this work assignment are consistent with the areas of analyses authorized in Tasks 7 and 9 of the contract's performance work statement.

III. PERFORMANCE WORK STATEMENT TASKS

Tasks and Deliverables:

The WA COR will review all deliverables in draft form and provide revisions and/or comments to the Contractor. The Contractor shall prepare the final deliverables incorporating the WA COR's comments.

Contractor personnel shall at all times identify themselves as Contractor employees and shall not present themselves as EPA employees. They shall not represent the views of the U.S. Government, EPA, or its employees. In addition, the Contractor shall not engage in inherently governmental activities, including but not limited to actual determination of EPA policy and preparation of documents on EPA letterhead.

Task 1 - Prepare Work Plan

The Contractor shall prepare a work plan within 15 calendar days of direction to commence work. The work plan shall outline, describe and include:

- The technical approach, resources timeline and due dates for deliverables;
- A detailed cost estimate by task; and
- A staffing plan.

The Contractor shall prepare a revised work plan incorporating the CO's comments, if required.

Deliverables and schedule under Task 1

1a. Submit work plan within 15 calendar days of receipt of work assignment.

1b. Submit revised work plan within 3 calendar days of receipt of comments from the Contracting Officer, if required.

Task 2 - Perform stochastic scenario analyses to quantify uncertainty in land use change GHG emissions

The Contractor shall run the Biofuels Stochastic international land use Lifecycle Analysis Model (BSLAM) to quantify uncertainty in biofuel-induced land use change GHG emissions. The Work Assignment Contracting Officer Representative (WA COR) will provide written technical direction to the Contractor for each scenario, including the necessary model inputs and scenario specifications. The Contractor shall implement minor adjustments and run the BSLAM given the requirements of each scenario as specified by the WA COR in the technical direction.

Based upon the written technical direction from the WA COR, the Contractor shall run the BSLAM and ensure that the model performs appropriately. As part of each scenario analysis, the Contractor shall perform quality assurance (QA) on the model results and provide a QA report to the WA COR documenting the QA procedures implemented and the findings from the QA process. The Contractor shall provide the scenario analysis results in electronic format through email to the work assignment COR. Results shall include the model outputs, such as total land use change GHG emissions with 95% confidence internals for each scenario, as well as disaggregated GHG emissions by region, time period, and land conversion type.

The Contractor shall prepare reports documenting the scenario analysis results for some but not all of the scenario analyses performed. Approximately 2-3 separate reports (approx. 10-20 pages each) will be required during the estimated period of performance. The WA COR will provide written technical direction to the Contractor with the requirements for each report. The reports delivered to the WA COR shall explain the analyses and results in plain English with technical details (e.g., complex equations) included in Appendices as appropriate.

Deliverables and schedule under Task 2

2a. Provide scenario analysis results to the WA COR within 5 business days after the WA COR submits technical direction

2b. Submit a QA report to the WA COR within 5 business days after the scenario analysis results are delivered to the WA COR

2c. Deliver a draft scenario analysis report to the WA COR within 15 business days after the WA COR submits technical direction

2d. Submit a final scenario analysis report to the WA COR within 5 business days after the WA COR submits comments on the draft report

Task 3 – Update and enhance the stochastic model

The Contractor shall update and enhance the BSLAM based on written technical direction from the WA COR. The WA COR shall provide updated datasets for the model (e.g., the satellite data and land conversion emissions factors) to the Contractor as appropriate. The Contractor shall input the data sets provided into the BSLAM and ensure that the model performs appropriately with the updated information.

The Contractor shall update the standard BSLAM result files so that additional information is reported with the results for each scenario analyzed. As specified in written technical directives by the WA COR, the Contractor shall revise the standard results files to include more information, including but not limited to the following items:

- *Land conversion emissions factors*. GHG emissions per hectare for each of the 12 agricultural land conversions (e.g., natural to perennial) in each of the 54 regions included in BSLAM. This shall include the mean, low and high emissions factors (95% confidence intervals) for each conversion/region.
- *Land conversions*. Land conversions calculated by the model for the mean, low and high results, by conversion type (e.g., savanna to annual cropland) for each Region, Country and if feasible each Administrative Unit.

As specified in technical direction from the WA COR, the Contractor shall provide the information listed above to the WA COR in detailed data tables, and also in summary format appropriate for use in reports and briefings. The Contractor shall provide the revised spreadsheets in electronic format through email to the WA COR.

As specified in written technical direction from the WA COR, the Contractor shall update the BSLAM documentation to reflect all of the updates and enhancements done under this task. The Contractor shall perform QA on all of model updates and enhancements implemented as part of this work assignment. The BSLAM documentation updated by the Contractor shall include a QA report documenting the QA procedures implemented and the findings of the QA process.

The Contractor shall participate in monthly update calls with the WA COR to discuss the progress made in completing Task 3. The WA COR will provide written technical direction specifying the details of the monthly update calls. More frequent update calls may be necessary during certain stages of the period of performance, in which case the additional update calls will be specified in written technical direction from the WA COR.

Deliverables and schedule under Task 3

3a. Provide a draft version of the updated BSLAM and draft updated documentation, including a QA report, to the WA COR by September 15, 2012.

3b. Provide a final version of the updated stochastic model and updated documentation, including a QA report, to the WA COR by September 30, 2012.

3c. Monthly update calls with the WA COR to discuss progress being made in completing Task 3.

Task 4 – Design a scenario analysis methodology to address uncertainty in key economic models used in lifecycle GHG analysis

EPA has developed a Draft Research Plan to Quantify Uncertainty in Key Economic Models (Draft Research Plan) used in Lifecycle GHG Analysis.[1] The draft report provides a conceptual discussion/framework for evaluating such uncertainties. The Contractor shall implement the next steps outlined in the draft research plan based on written technical direction from the WA COR. The Contractor shall design a scenario analysis methodology to evaluate the behavior of different economic models to changes in key assumptions. This shall include developing a framework to specify ranges for intermediate variables (e.g., fertilizer use, price elasticity of agricultural land supply, cattle stocking rates) that are important in estimating lifecycle GHG emissions. It shall also involve outlining appropriate modeling procedures to implement the scenario analysis. The Contractor shall design the scenario analysis to facilitate assessment of either a post processor and/or reduced form model to address uncertainty.

The Contractor shall participate in monthly update calls with the WA COR to discuss the progress made in completing Task 4. The WA COR will provide written technical direction specifying the details of the monthly update calls. More frequent update calls may be necessary during certain stages of the period of performance, in which case the additional update calls will be specified in technical direction from the WA COR. (The update calls for Task 3 and Task 4 will likely be scheduled at the same time based on written technical direction from the WA COR).

Deliverables and schedule under Task 4

4a. Provide a draft scenario analysis methodology in electronic format by September 1, 2012.

4b. Provide a final scenario analysis methodology in electronic format by September 30, 2012.

4c. Monthly update calls with the WA COR to discuss progress being made in completing Task 4.

Task 5 – Quick turn-around and technical support

The Contractor shall provide specialized expertise on uncertainty assessment, or perform model runs, on an as needed basis to: (i) consult with EPA on various aspects of uncertainty associated

[1] ICF International. 2011. Draft Research Plan to Quantify Uncertainty in Key Economic Models used in Lifecycle GHG Analysis. Draft report submitted to the EPA. September 30, 2011.

with lifecycle GHG analysis of biofuels, (ii) review, summarize and critique academic literature and other research related to uncertainty associated with lifecycle GHG analysis of biofuels, (iii) perform quick-turn modeling or quantitative analysis related to uncertainty assessment, (iv) prepare presentations and present analyses to EPA staff and stakeholders, and (v) revise existing analyses and reports. These quick response tasks may require the involvement of collaborative researchers who have expertise identified in the Statement of Work. Quick turn-around tasks are expected to take 1-2 weeks each, but some quick-turn around tasks may require deliverables from the Contractor in 24-48 hours. The details and schedule of deliverables for these quick turnaround and technical support requests will be included in written technical direction from the WA COR. The total expected level of effort on this task would be 26 hours.

Baseline Schedule of Deliverables under Task 4

5a. Deliver draft results of the quick turn-around technical support within 5 business days after the WA COR submits technical direction

5b. Deliver final results of quick turn-around technical support within 5 business data after the WA COR provides comments on the draft results

Travel:

This WA may include one trip by the Contractor in order to inform EPA and stakeholders of progress, or present study results generated under the WA at a professional conference or similar event. If necessary, the trip will be to a location in the eastern or central time zone in the United States. The Contractor will send one person on the trip, if necessary. As specified in written technical direction from the WA, the Contractor may be required to present a short presentation, such as a slide show, of approximately 30 minutes in duration.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-03

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2012	Powertrain Testing and Validat
	Base X Option Period Number	

Contractor: ICF INCORPORATED, L.L.C.

Specify Section and paragraph of Contract SOW: Subtasks 2g and 2h

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 05/29/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
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Authorized Work Assignment Ceiling

Contract Period: 02/01/2012 To 09/30/2012 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Houshun Zhang (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4214 FAX Number:
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name: Jose Ortiz (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2831 FAX Number: 513-487-2109
Contracting Official Name: Sandra Savage (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2046 FAX Number:

PERFORMANCE WORK STATEMENT

A.	EPA Contract:	EP-C-12-011
B.	Work Assignment (WA):	0-03
C.	Issuing Office:	EPA Office of Transportation and Air Quality (OTAQ) 2000 Traverwood Dr. Ann Arbor, Michigan 48105
D.	Contractor:	ICF International 9300 Lee Highway Fairfax, VA 22031-1207
E.	Statement of Work:	Powertrain Tests and Validations
F.	Work Assignment Managers (WAM)	Houshun Zhang 734-214-4214 zhang.houshun@epa.gov
	Alternate WAM	Christine Brunner 734-214-4287 brunner.christine@epa.gov

I. BACKGROUND

The U.S. Environmental Protection Agency (EPA) and the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) recently announced a first-ever program to reduce greenhouse gas (GHG) emissions and improve fuel efficiency of heavy-duty trucks and buses. This program is the first phase of the multi-stage GHG reduction approach. Hybrid system certification is part of the program. Due to technical challenges to quantify hybrid vehicle benefits as opposed to conventional vehicles, the agencies, working together with industrial stakeholders, are developing different concepts for certification. One of the concepts is powertrain test or powerpack test approach. The powertrain system includes engine, hybrid related components, and transmission. This approach must rely on a conventional baseline for use of comparison with the new hybrid system. The challenge is how to select, test, and validate this conventional powertrain baseline system without the hybrid system. To date very little work has been done in this area. Consequently, this work assignment will spearhead the efforts to select, test, and validate the baseline powertrain system before moving to the more complicated hybrid system. The contractor shall select a few representative vehicles, remove powertrain baselines from the selected vehicles, and perform engine, powertrain, and vehicle tests. Due to the time sensitivity and complexity of this project that will involve vehicle chassis dyno test, engine and powertrain dyno tests, and hardware-in-loop software development, it is highly

desirable that the contractor be able to handle all tasks in one physical location to deliver program objectives in a timely and cost effective manner.

II. OBJECTIVE

The main objective of this program is to conduct the proof of the powertrain system concept. The second objective is to use vehicle chassis dyno test to validate powertrain system concept through simulated vehicle driving cycles. The proposed work will be used as the critical baseline when the benefits of hybrid vehicle system are quantified in a separate project. The scope of this work is described in detail in the next section.

III. SCOPE OF WORK

Task 1: Truck and trailer procurement

The Contractor shall provide one (1) vocational truck for testing under this work assignment. The truck shall be a 2010 or later model, and shall be equipped with an engine that meets the 0.20g/hphr of Nox. Vocational trucks for the purposes of this work assignment range from Class 4 to Class 8, and include delivery trucks, utility trucks, refuse trucks, and buses. EPA recommends that vehicles with Cummins ISB engines be considered, and welcomes suggestions of other engines by the Contractor. The Contractor shall ensure EPA WAM approval of the proposed truck/engine combination prior to acquiring the vehicle.

For the purposes of this work assignment, the acquired vehicle will not become government-furnished property. The Contractor shall ensure appropriate disposition of the vehicle after all testing is completed.

Task 2: Coastdown test, per truck

The Contractor shall conduct coastdown tests on the truck selected under Task 1 using the test procedure described in part 1066.310 of Title 40. This test procedure shall be used to obtain estimates of road load and aerodynamic drag for input to dynamometer settings as well as inputs for modeling in terms of A and C coefficients. This test consists of 10 valid replicate coastdowns done in each alternating direction to minimize the effect of wind (a total of 20 runs per vehicle).

Task 3: Truck chassis dynamometer test for fuel economy and emissions

The Contractor shall measure emissions and fuel economy on the truck selected under Task 1 based on standard EPA emissions testing and fuel economy methods outlined in the United States Code, Title 40, part 1066.

The Contractor shall collect data using cell emission equipment.

Depending on vehicles and applications, different driving cycles shall be used to test the vehicle. The truck shall be subjected to a minimum of five driving cycles. Via written technical direction, the EPA WAM will specify the driving cycle(s) to be run on the truck. Five valid replicate runs are required for each driving cycle. A valid replicate is a successful test run in which all data are collected and there is no regeneration of the diesel particulate filter.

The following parameters shall be measured or recorded as appropriate:

- Vehicle speed as function of time
- Engine fueling as function of time
- Engine speed as function of time
- Gear number as function of time
- Engine load (N-M) as function of time
- Emissions (NOx, HC, CO, CO2, N_2O, CH_4) in g/s as function of time
- Measured cycle MPG and emissions (NOx, HC, CO, CO2, PM, N_2O, CH_4)
- Grade as function of time for the cycle with gradeability

Vehicle/engine pedal position as function of time shall be measured if it can be accomplished.

While actual gear number is required, the Contractor shall compare the recorded gear number with a calculated results based on deduction from other relevant testing data.

The results from this task, including fuel consumption and emissions, shall be used for validation of the powertrain tests under Task 4.

The contractor shall obtain and provide the EPA WAM with the engine and vehicle parameters as indicated in Table 1.

Table 1. Engine and Vehicle Parameters

1	Engine Model and Year
2	Engine rating and displacement
3	Transmission Model and Year
4	Transmission (Numbers of speed, auto or manual)
5	Gearbox Ratio
6	Gearbox Efficiency as function of gear number
7	Engine Inertia [kg-m^2]
8	Transmission Inertia [kg-m^2]
9	All Axle Inertia [kg-m^2]
10	Loaded Tire Radius [m]
11	Rolling Resistance for Each Tire (kg/Metric ton)
12	Total Weight [kg]
13	Frontal Area [m^2]
14	Aero Drag Coefficient
15	Axle Base (numbers of axles)
16	Electrical Accessory Power [W]
17	Mechanical Accessory Power [W]
18	Final Drive (Axle) Ratio

Some of the inertia data may require special testing, such as combination inertia of wheel, tire and axle if the data is not available from the supplier. The Contractor shall consult with the EPA WAM prior to initiating such special testing. The Contractor shall discuss with the EPA WAM any limitations in accomplishing the requirements of this task.

Task 4: Powertrain baseline tests

The contractor shall conduct powertrain tests, which includes engine and transmission as a system. The contractor shall pull the engine and transmission out of the vehicle and install it in a powertrain dyno cell for tests after completion of Task 3. Prior experience in handling this kind of powertrain test is essential. The powertrain test cell shall be available at the time when the powertrain test is set to start. The contractor shall setup the powertrain cell that includes both

engine and transmission. All necessary sensors and instruments shall be installed for the required measurements indicated in the following paragraph. The contractor shall test the baseline operation first, making sure that the powertrain system can be operated properly. One set of powertrain system tests shall be conducted with six specific driving cycles that are used to simulate vehicle driving cycles.

The following parameters shall be measured during tests as function of time:

- Torque at the transmission output shaft
- Engine torque
- Engine fueling rate
- Simulated vehicle fueling consumption in mile per gallon (MPG)
- Engine speed
- Transmission speed at the output shaft
- Simulated vehicle speed
- Accelerate and braking command in term of percentage
- Emissions (CO2 , NOx, CO, HC)
- Cycle-weighted particulate matter (PM)

No diesel particulate filter (DPF) regeneration shall occur during any of these tests.

The performance and emission comparisons shall be made between the vehicle test and powertrain test for each driving cycle conducted by each powertrain system. A detailed analysis and report shall be generated to summarize the comparisons and findings between vehicle chassis dyno and powertrain dyno tests.

Task 5: Hardware-in-loop development

In conjunction with Task 4, the contractor shall develop a vehicle and driver model in order to simulate vehicle operation through a powertrain system test. EPA WAM will first provide its own vehicle and driver model to the Contractor as a baseline to start with. The Contractor shall then modify the vehicle and drive model provided by the EPA WAM in order to allow the model to communicate with the powertrain hardware. Finally, the contractor shall develop a protocol to communicate the powertrain system hardware with the modified vehicle and driver models. Figure 1 provides the technical communication sketch between hardware and software:

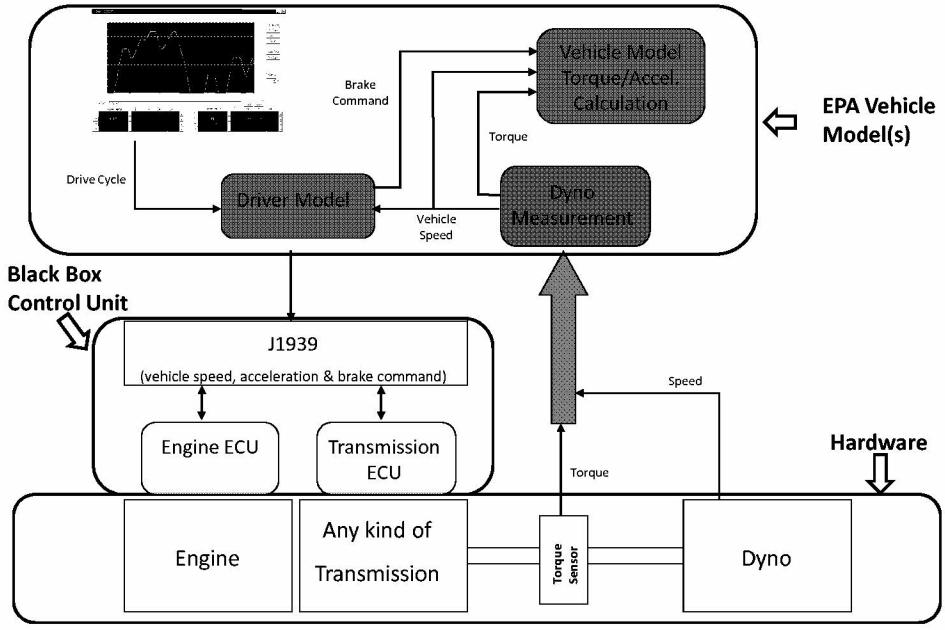

Figure 1- Powertrain system communication sketch

As shown by Figure 1, the entire system consists of three major components – hardware, black box control unit, and vehicle model. It is expected that the vehicle and driver model shown in Figure 1 shall have adequate fidelity capable of modeling vehicle performance accurately with highly transient driving cycles.

Final validation of this task in a powertrain cell depends on the completion of Task 4.

IV. DELIVERABLES

1. Quality Assurance Project Plan (QAPP).

The contractor shall submit a draft QAPP to the EPA WAM within 30 days of Work Plan submission. The QAPP shall detail data collection and analysis tasks and procedures for this work assignment. The EPA WAM shall review and comment on the QAPP. The contractor shall incorporate recommended changes and suggestions received before proceeding with technical work associated with the tasks below. A final QAPP shall be submitted within 15 days after receipt of EPA comments. Information on completing a QAPP can be found at http://www.epa.gov/quality/at/extramural.html (general requirements) and /qatools.html (QMP/QAPP).

The final QAPP shall cover all aspects of this test program as outlined on the EPA quality website. The QAPP shall have an appendix containing all applicable standard operating procedures (SOPs). The contractor shall adhere to all applicable SOPs and the QA procedures recommended therein. The contractor shall notify the EPA WAM immediately if they encounter

any equipment failures that cannot be remedied, problems that may impact the quality or on-time receipt of deliverables, or unavailability of items required for this work assignment.

2. Bi-Weekly Progress Reports.

The contractor shall provide the EPA WAM with bi-weekly status reports via telephone conference or email during the period of performance. The progress report shall indicate the progress achieved in the concluded weeks, technical problems encountered, solutions to those problems, and projected activity for the upcoming weeks. Before proceeding with any solution to a problem, the contractor shall report the problem and consult with the EPA WAM concerning the scope of the solution. The bi-weekly progress report shall include an estimate of the percentage of each task completed to date, and the resources (level of effort and cost) expended on each task.

3. Technical Reports.

The contractor shall provide EPA WAM with a brief Technical Report upon completion of each task. Depending on the complexity of the subject matter and as directed via written technical direction by the EPA WAM, these reports shall be in the form of either a presentation or a formal written document. Written products shall be delivered in formats specified by the EPA WAM (e.g., Word, Excel).

4. Data.

The contractor shall provide the EPA WAM with raw test data of the completion of each test within 2 business days of receiving request for such data via written technical direction. The contractor shall provide to the EPA WAM valid test data from the vehicle for each task within 14 days of completion of the testing on the vehicle. All data shall be presented in an Excel format.

5. Draft and Final Reports.

The contractor shall provide to the EPA WAM a Draft Final Report and data set summarizing the result of all the tasks within 30 days of completion of the laboratory and modeling work defined in the Tasks above. The contractor shall deliver the Final Report within 15 days from the day that the EPA WAM delivers the reviewed draft report back to the contractor.

Schedule of Deliverables

Steps	**Completion Date**
QAPP submission	Within 30 days of Work plan submission
Final QAPP	Within 15 days of receiving EPA comments
Complete all tasks	Before September 30, 2012
Test Data	Raw data - within 2 business days of EPA WAM request Vehicle test data - within 14 days of completion of testing on the vehicle.
Draft Final Report	Within 30 days of completion of all tasks
Final Report	Within 15 days of receipt of EPA comments on Draft Final Report

NON-DISCLOSURE AGREEMENT

All documentation acquired and/or provided by EPA or generated as a result of this project shall be under the control of the U.S. EPA Assistant Administrator for Air and Radiation, or his or her designated representative, and shall not be released by the Contractor to any other source without specific approval by U.S. EPA.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-03

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2012	Powertrain Testing and Validat
	Base X Option Period Number	

Contractor: ICF INCORPORATED, L.L.C.

Specify Section and paragraph of Contract SOW: Tasks 2g and 2h

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 05/29/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 02/01/2012 To 09/30/2012 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Houshun Zhang (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4214 FAX Number:
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name: Jose Ortiz (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2831 FAX Number: 513-487-2109
Contracting Official Name: Sandra Savage (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2046 FAX Number:

PERFORMANCE WORK STATEMENT

A.	EPA Contract:	EP-C-12-011
B.	Work Assignment (WA):	WA 0-03 Amendment 1
C.	Issuing Office:	EPA Office of Transportation and Air Quality (OTAQ) 2000 Traverwood Dr. Ann Arbor, Michigan 48105
D.	Contractor:	ICF International 9300 Lee Highway Fairfax, VA 22031-1207
E.	Statement of Work:	Powertrain Testing and Validation
F.	Work Assignment Managers (WAM)	Houshun Zhang 734-214-4214 zhang.houshun@epa.gov
	Alternate WAM	Christine Brunner 734-214-4287 brunner.christine@epa.gov

I. BACKGROUND

This amendment adds an additional vehicle for testing of that vehicle.

II. SCOPE OF WORK

Task 1 is revised to read as follows (new language is in *italics*):

Task 1: Truck and trailer procurement

Task 1a - Initial vehicle procurement
The Contractor shall provide one (1) vocational truck for testing under this work assignment. The truck shall be a 2010 or later model, and shall be equipped with an engine that meets the 0.20g/hphr of NOx. Vocational trucks for the purposes of this work assignment range from Class 4 to Class 8, and include delivery trucks, utility trucks, refuse trucks, and buses. EPA recommends that vehicles with Cummins ISB engines be considered, and welcomes suggestions of other engines by the Contractor. The Contractor shall ensure EPA WAM approval of the proposed truck/engine combination prior to acquiring the vehicle.

For the purposes of this work assignment, the acquired vehicle will not become government furnished property. The Contractor shall ensure appropriate disposition of the vehicle after all testing is completed.

Task 1b - Class 8 Truck
The Contractor shall provide one long haul class 8 truck with a trailer and automated manual transmission (AMT) for testing under this amendment. The truck shall be a 2010 or later model, and shall be equipped with an engine that meets the 0.20g/hphr of NOx. EPA recommends that vehicles with Cummins ISX engines be used. The Contractor shall ensure EPA WAM approval of the proposed truck/engine combination prior to acquiring the vehicle.

For the purposes of this work assignment, the acquired vehicle will not become government-furnished property. The Contractor shall ensure appropriate disposition of the vehicle after all testing is completed.

Tasks 2 and 3:

In addition to the original applicability of Task 2 and 3, the procedures contained in those tasks shall be applied to the vehicle procured in Task 1b.

IV. DELIVERABLES

The acquisition and testing applicable to this amendment shall be completed prior to September 30, 2012. All other deliverables and schedules contained in the approved work plan continue to apply.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-04

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2012	Fuels for Gasoline Light-Duty
	Base X Option Period Number	

Contractor	Specify Section and paragraph of Contract SOW
ICF INCORPORATED, L.L.C.	Task 1; 1d Fuel Blending

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 06/05/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period:	Cost/Fee:	LOE:
02/01/2012 To 09/30/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Rafal Sobotowski (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4228 FAX Number:
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name: (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Sandra Savage (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2046 FAX Number:

Performance Work Statement

Contract EP-C-12-011	Work Assignment Number 0-04
Issuing Office	Environmental Protection Agency 2000 Traverwood Drive Ann Arbor, MI 48105-2498
Contractor	ICF International 9300 Lee Highway Fairfax, VA 22031
Title	Fuels for Gasoline Light-Duty Exhaust Emissions Study

EPA Personnel

Work Assignment Manager (WAM)	Rafal Sobotowski 734/214-4228 Sobotowski.rafal@epa.gov
Alternate WAM	Christine Brunner 734/ 214-4287 Brunner.christine@epa.gov

BACKGROUND

The Environmental Protection Agency (EPA) would like to conduct an an experimental study aimed at filling significant data gaps in our understanding of how the properties of gasoline fuels affect exhaust emissions from the newest technology (Tier 2) SI-powered vehicles. Fuel properties of interest include T50, T90, ethanol content, and aromatic hydrocarbon content. The nature of this study requires custom design and blending of the test fuels as well as control of numerous other fuel properties such as vapor pressure, benzene content, sulfur content or octane number.

The EPA desires to develop the recipes of four test fuels in coordination with the Contractor and reuse two formulations developed recently for another program. This will require the contractor to provide the properties of the blending components to the EPA for use in test fuel design.

TASKS

Task 1 Work Plan Development

The Contractor shall prepare a detailed Work Plan from the requirements in this Performance Work Statement. The Contractor shall include all steps anticipated and potential challenges and alternatives. The schedule shall be included with detailed deliverables and associated dates.

The work plan shall include descriptions of each task to be accomplished, along with detail on the level of effort by professional grade, a cost breakdown for each task, and any information on the underlying assumptions used in arriving at these cost estimates. The Contractor shall conduct necessary activities to properly and efficiently manage the work assignment, including at least weekly communication with the EPA Work Assignment Manager (WAM).

Task 2 Quality Assurance Project Plan and Quality Management Plan (QAPP/QMP)

The Contractor shall submit a Quality Assurance Project Plan (QAPP) to the EPA WAM for approval.

Task 3 Provide Qualities of Blendstocks

Appendix A describes the fuel properties of the following six test fuels of interest:

1) EPAct 7;
2) EPAct 26;
3) EPAct 13 Mod;
4) 100;
5) 101; and
6) 102.

These fuels include biofuels and conventional fuels, and the analysis of fuel quality is integral to the development of their formulations. General descriptions of the final formulations are as follows:

- The starting recipes of fuels EPAct 7 and EPAct 26 will be identical to those developed in the EPAct Program. They may require minor fine tuning to account for the current properties of the blending components

- The development of fuel EPAct 13 Mod will start with the recipe of EPAct fuel 13 which will be modified to achieve T50=193°F and a more uniform C7, C8, C9 and C10+ aromatic distribution

- Fuel 100 will be a new formulation

- Fuel 101 will be blended by increasing the C10+ aromatic content in fuel 100 to 17.5 vol. % and adjusting ethanol and DVPE to fuel 100 levels

- Fuel 102 will be blended by increasing the toluene content in fuel 100 to 20.5 vol. % and adjusting ethanol and DVPE to fuel 100 levels

The Contractor shall provide detailed blendstock property (quality) data to the EPA WAM. Blendstocks shall be refinery components and/or cuts of refinery components. Reagent or laboratory chemicals and chemical blendstocks shall not be used except where specified by name

(e.g., toluene, benzene). In addition, butane may be used to adjust DVPE. Denatured ethanol meeting the requirements of ASTM D4806 standard shall be used in all ethanol containing fuels.

Based on the blendstock properties, the EPA WAM will generate a recipe for each test fuel and forward it to the Contractor.

Task 4 Preparation and Analysis of Hand Blends

Based on the fuel recipes provided by the EPA WAM, the Contractor shall prepare hand blends of the first five (5) fuels and shall analyze them. Upon receipt of written technical direction from the EPA WAM, the Contractor shall also prepare a hand blend of the last fuel – Fuel 102 and shall analyze it.

The analyses required shall include D5599 ethanol, D86 distillation, D5191 DVPE, D1319 FIA and D6729 detailed composition. The following situations and Notes shall be considered:

- If the predicted S content of any blend is ≥ 27 ppm, then S by D5453 shall also be measured

- If the predicted benzene content of blend EPAct 7, EPAct 13 Mod, 100 or EPAct 26 is ≥ 0.70, then benzene by D3606 shall also be measured

- If the predicted anti knock index ((R=M)/2) of this blend ≤ 89.0, D2699 research and D2700 motor octane numbers shall also be measured

Note: Convert D5599 ethanol results to vol% per Section 14.3 of D4815.

Note: Correct D1319 results for ethanol content of the fuel.

Note: Use only OptiDist distillation stills to generate D86 distillation data. Set them to measure charge volume in the receiving cylinder.

Note: Calculate D5191 DVPE using the EPA equation per 40 CFR, Part 80.46. Report total pressure measured during the test along with DVPE.

Note: Report D6729 detailed composition data in Honda format. The EPA WAM will use D6729 data provided by the Contractor to calculate C7, C8, C9 and C10+ aromatic composition of the fuels.

Task 5 Independent Laboratory Analysis of Hand Blends

Once the analytical results generated by the contractor in Task 4 indicate that a given test fuel hand blend meets the ethanol, T10, T50, T90, FBP, DVPE and detailed composition requirements of the specification provided in Appendix A (and also benzene, sulfur and anti knock index ((R+M)/2) if called for in Task 4), the contractor shall submit a sample of the blend

to an independent laboratory for the following analyses: D5599 ethanol, D86 distillation, D5191 DVPE, and D1319 FIA.

Note: Convert D5599 ethanol results to vol % per Section 14.3 of D4815.

Note: Correct D1319 results for ethanol content of the fuel.

Note: Use only OptiDist distillation stills to generate D86 distillation data. Set them to measure charge volume in the receiving cylinder.

Note: Calculate D5191 DVPE using the EPA equation per 40 CFR, Part 80.46. Report total pressure measured during the test along with DVPE.

Task 6 Submittal of Hand Blend Quality Analyses Results

When the analytical results generated by the contractor and the independent laboratory in Tasks 4 and 5 indicate that a given test fuel hand blend meets the ethanol, T10, T50, T90, FBP, DVPE, detailed composition (and also benzene, sulfur and anti knock index (R+M)/2 if called for in Tasks 4 and 5) requirements of the specification provided in Appendix A, they shall be presented to the EPA WAM for approval. The following Note shall be considered:

Note: It is expected that Tasks 4 and 5 will require the following number of hand blend iterations, for a total of up to 17 (for cost estimation purposes, the Contractor shall include the individual cost of additional hand blends over 17):

Fuel	EPAct 7	EPAct 13 Mod	100	EPAct 26	101	102
Expected # of Hand Blend Iterations	3	3	4	3	2	2

Task 7 Preparation and Analysis of Bulk Blends

Upon approval of the hand blend inspection data, the EPA WAM will generate the final specification for the bulk blend of each test fuel based on the following template:

Final Specifications Table

PROPERTY	UNIT	METHOD	BLENDING TOLERANCE	SPECIFICATION
Density, 60°F	-	D4052	NA	Report
API Gravity, 60°F	°API	D4052	NA	Report
Ethanol	vol. %	D5599	E0: < 0.1; E15: ± 0.5;	Per Appendix A
Total Content of	vol. %	D5599	-	<0.1

Oxygenates Other than Ethanol				
O	mass %	D5599	-	Report
T10	°F	D86	± 5	Value approved by EPA WAM in Task 6
T30	°F	D86	± 5	Value approved by EPA WAM in Task 6
T50	°F	D86	± 4	Value approved by EPA WAM in Task 6
T70	°F	D86	± 5	Value approved by EPA WAM in Task 6
T90	°F	D86	± 5	Value approved by EPA WAM in Task 6
FBP	°F	D86	-	<437
DVPE (EPA equation)	psi	D5191	± 0.15	Value approved by EPA WAM in Task 6
Benzene	vol. %	D3606	± 0.15	Value approved by EPA WAM in Task 6
Toluene	vol. %	D6729	± 1	Value approved by EPA WAM in Task 6
C8 Aromatics	vol. %	D6729	± 1	Value approved by EPA WAM in Task 6
C9 Aromatics	vol. %	D6729	± 1	Value approved by EPA WAM in Task 6
C10+ Aromatics	vol. %	D6729	± 1	Value approved by EPA WAM in Task 6
S	mg/kg	D5453	± 5	25
(R + M)/2	-	Calc.	-	Per Appendix A
C (Part of D4809)	mass %	D5291	-	Report
H (Part of D4809)	mass %	D5291	-	Report
Water Content	mg/kg	E1064	-	Report
Net Heat of Combustion	MJ/kg	D4809	-	Report
Oxidation Stability	minute	D525	-	>240
Copper Strip Corrosion, 3h at 122°F	-	D130	-	<No. 1

Solvent-Washed Gum Content	mg/100 ml	D381	-	< 5

The contractor shall prepare 300 gallon bulk blends of test fuels EPAct 7, EPAct 13 Mod, 100 and EPAct 26 and 101, and adjust their properties until the blends meet the specifications defined in the Final Specifications Table above. The following situations and Notes shall be considered:

- Density, ethanol, distillation, DVPE, benzene, detailed composition, sulfur and anti-knock index ((R+M)/2) shall be first measured by the contractor.

Note: The sulfur content of these fuels shall be adjusted using a three-component sulfur mixture containing 4.3 mass% dimethyl disulfide, 22.8 mass% thiophene, and 72.9 mass% benzothiophene.

- The fuel shall also be analyzed by an independent laboratory in two phases:

  Phase 1: Initially, ethanol, distillation, DVPE, benzene, sulfur and anti-knock index ((R+M)/2) shall be determined.

  Phase 2: The remaining fuel properties shall be determined only when the average values of ethanol, distillation parameters, DVPE, benzene, sulfur and anti-knock index ((R+M)/2) determined by the contractor and the independent laboratory have been shown to meet the requirements of the specifications defined in the Final Specifications Table above. They must also be within the reproducibility limits of each test method.

Note: Convert D5599 ethanol results to vol % per Section 14.3 of D4815.

Note: Use only OptiDist distillation stills to generate D86 distillation data. Set them to measure charge volume in the receiving cylinder.

Note: Calculate D5191 DVPE using the EPA equation per 40 CFR, Part 80.46. Report total pressure measured during the test along with DVPE.

Note: D6729 detailed composition data must be reported in Honda format. The EPA WAM will use D6729 data provided by the contractor to calculate C7, C8, C9 and C10+ aromatic composition of the fuels.

Note: D5291 as written is not applicable to gasoline. Measure C and H by D5291 only at a laboratory which has adapted the test method to gasoline.

Once the analytical results generated by the Contractor and the independent laboratory indicate that the bulk blend meets the specification defined in the Final Specifications Table above, the contractor shall present these results to the EPA WAM for approval. Upon approval by the EPA WAM, an oxidation inhibitor shall be added to the fuel and the whole bulk blend shall be

transferred into 5B drums. The Contractor shall ensure the use of fuel storage and handling practices that will minimize, to the greatest extent possible, any changes in the properties of finished fuels or mislabeling of fuel drums. Upon written technical direction from the EPA WAM, the Contractor shall also prepare 300 gallons of fuel 102 in the same manner as described above for the other fuels (the cost estimate shall indicate the cost of this volume separately).

In addition, upon written technical direction from the EPA WAM, the Contractor shall prepare an additional 50 gallons of any fuel prepared under this WA 0-04. Such technical direction will be provided prior to the preparation of the bulk blend. The cost estimate shall indicate the cost of such a 50 gallon increment.

A 1-quart sample of each fuel shall be shipped by the Contractor to the EPA as provided in written technical direction by the EPA WAM. The Gasoline Sampling Procedure provided in Appendix B shall be used to take fuel samples from drums.

Task 8 Fuel Storage

The Contractor shall provide for the storage of the bulk blends. Storage shall be in the Detroit, MI, area for a period of up to 5 months, indoors, at temperatures not exceeding 75°F. The storage parameters are required to ensure minimal changes in fuel quality. Because the fuel drums shall be gradually removed from the storage facility by the EPA as the emissions test program progresses, a monthly decline in the number of drums stored can be expected, and shall be a factor in the cost determination.

DELIVERABLES

Weekly and Reports

The Contractor shall provide 15-20 minute telephone conference reports weekly to review progress to date. These oral reports shall indicate progress achieved in the preceding week, technical issues encountered, solutions to issues (proposed or attempted), and projected activity in the following week. They shall include any potential issues or circumstances that may be causing delays in the execution of this project. The EPA WAM or his/her designated alternate shall participate in these phone conferences.

Biweekly Reports

The Contractor shall provide the EPA WAM with a brief, biweekly, written report summarizing hours and dollars expended on the Tasks in this work assignment.

Monthly Written Progress Reports

The Contractor shall provide monthly progress reports. The reports shall track percentages of hours used in each task and whether the project is on schedule. The Contractor shall explain

problems encountered including resolutions and indicate if the schedule or budget was compromised.

The reports shall summarize the progress made during the reporting month, technical issues encountered, solutions to issues (proposed or attempted), and projected activity in the following month.

Data Files

Throughout the duration of this project, the Contractor shall submit fuel inspection data in Microsoft Excel format for review by the EPA WAM as soon as practicable.

Draft Final Report

The Contractor shall develop a draft final report that details the work completed and results from Task 3. This report shall include:

1) Detailed fuel specifications
2) Changes in specifications submitted by the EPA WAM
3) Description of issues encountered
4) Final fuel inspection data
5) Quantities procured

The draft final report shall be delivered to the EPA WAM within ten working days of approval of the last fuel for storage or shipment.

Final Report

The Contractor shall provide the final report, incorporating EPA comments, within 10 working days of receiving comments from EPA WAM. The report shall be submitted in both Microsoft Word and Adobe portable document files (*.pdf) formats.

Schedule of Deliverables

Steps	Completion Date
Fuel data delivered to EPA WAM	On-going
Completion of fuel recipe (hand blends) development	July 20, 2012
Data on final bulk fuel blends submitted to EPA WAM for approval	August 17, 2012
Draft final report submission	September 1, 2012
Final report submission	10 working days from receipt of EPA WAM comments

Appendix A

Gasoline Light-Duty Exhaust Emissions Study

Test Fuel Specification

PROPERTY	UNIT	METHOD	BLENDING TOLERANCE	Test Fuel						INSTRUCTIONS
				EPAct 7	EPAct 13 Mod	100	EPAct 26	101	102	
				EPAct fuel	EPAct fuel #13 modified to achieve T50=193 °F and more uniform C7, C8, C9 and C10+ aromatic distribution	New fuel	EPAct fuel	Fuel 100 plus 15% of C10+ aromatics, w/ethanol and DVPE adjusted to fuel 100 levels	Fuel 100 plus 15% of toluene, w/ethanol and DVPE adjusted to fuel 100 levels	
Density, 60°F	g/cm^3	D4052	NA	Report	Report	Report	Report	Report	Report	
API Gravity, 60°F	°API	D4052	NA	Report	Report	Report	Report	Report	Report	
Ethanol	vol. %	D5599	E0: < 0.1; E15: ± 0.5	0	0	15	15	15	15	D5599 reports in mass %. Convert to vol. % per Section 14.3 of D4815
Total Content of Oxygenates Other Than Ethanol			-	<0.1	<0.1	<0.15	<0.15	<0.15	<0.15	
O	mass %		-	Report	Report	Report	Report	Report	Report	
T10	ºF	D86 (OptiDist or equivalent)	-	<158	<158	<158	<158	Report	Report	Make sure that the distillations are done with the still set to measure charge volume in the receiving cylinder
T50			± 4	193	193	160	160	Report	Report	
T90			± 5	300	340	300	340	Report	Report	
FBP			-	<437	<437	<437	<437	Report	Report	
DVPE (EPA equation)	psi	D5191	± 0.15	7.2	7.2	10.2	10.2	10.2	10.2	
Aromatics	vol. %	D1319	-	Report	Report	Report	Report	Report	Report	Correct results for ethanol content
Saturates			-	Report	Report	Report	Report	Report	Report	
Olefins			-	Report	Report	Report	Report	Report	Report	
Benzene	vol. %	D3606	± 0.15	0.62	0.62	0.62	0.62	Report	Report	
Detailed Composition	vol. %	D6729	-	Report	Report	Report	Report	Report	Report	Report results in Honda format, also in mass % and mol %
Benzene			-	Report	Report	Report	Report	Report	Report	
Toluene			± 1	5.5	11.5	5.5	10	Report	20.5	
C8 Aromatics			± 1	5.5	11.5	5.5	10	Report	Report	
C9 aromatics			± 1	5.5	11.5	5.5	10	Report	Report	
C10+ Aromatics			± 1	2.5	5.5	2.5	8	17.5	Report	
Total Aromatics			± 2	19	40	19	38	Report	Report	
Cycloparaffins			-	Report	Report	Report	Report	Report	Report	
Olefins			-	Report	Report	Report	Report	Report	Report	
Ethanol			-	Report	Report	Report	Report	Report	Report	
S	mg/kg	D5453	± 5	25	25	25	25	25	25	
RON	-	D2699	-	Report	Report	Report	Report	Report	Report	
MON	-	D2700	-	Report	Report	Report	Report	Report	Report	
(R + M)/2	-	Calc.	-	≥89	≥91	≥91	≥91	≥91	≥91	
C (Part of D4809)	mass %	D5291	-	Report	Report	Report	Report	Report	Report	D5291 as written is not applicable to gasoline. Perform this test at a laboratory which has adapted it to gasoline
H (Part of D4809)			-	Report	Report	Report	Report	Report	Report	
Water	mg/kg	E1064	-	Report	Report	Report	Report	Report	Report	
Lead	g/l	D3237	-	Report	Report	Report	Report	-	-	
Net Heat of Combustion	mass %	D4809	-	Report	Report	Report	Report	Report	Report	
Oxidation Stability	minute	D525	-	>240	>240	>240	>240	>240	>240	
Copper Strip Corrosion, 3h at 122°F	-	D130	-	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	<No. 1	
Solvent-Washed Gum Content	mg/100 ml	D381	-	< 5	< 5	< 5	< 5	< 5	< 5	

May 31, 2012

Appendix B

Gasoline Sampling Procedure

1. Cool the fuel inside the drum, sampling equipment and sample containers to a temperature not exceeding 50°F

    - Use a hand transfer pump

    - The glass sample container must meet the following requirements:

        i. 1 qt. capacity
        ii. Its cap must be equipped with a neoprene seal

2. Position the sampling tube to take the fuel sample from the mid-height of the fuel level in the drum

3. Using the hand transfer pump, activate the flow of fuel from the drum into a slop container and slop at least 1 qt. of fuel

4. Fill the sample container to 75-80% of capacity and seal tightly to prevent sample losses

    - Make sure that during sampling the fuel flows gently (w/o splashing) into the sampling container. Use a filling tube that reaches to the bottom of the container

5. Store the sample at a temperature not exceeding 50°F prior to opening the sample container

6. Have the sample analyzed as quickly as possible

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-05

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2012	GHG Transportation Inventory D
	Base X Option Period Number	

Contractor: ICF INCORPORATED, L.L.C.

Specify Section and paragraph of Contract SOW: Task 7a

Purpose:
- ☒ Work Assignment
- ☐ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 06/29/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 02/01/2012 To 09/30/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Venu Ghanta (Signature) (Date)	Branch/Mail Code: Phone Number: 202-564-1374 FAX Number:
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name: Venu Ghanta (Signature) (Date)	Branch/Mail Code: Phone Number: 202-564-1374 FAX Number:
Contracting Official Name: Sandra Savage (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2046 FAX Number:

PERFORMANCE STATEMENT OF WORK

A.	EPA Contract:	EP-C-12-011
B.	Work Assignment (WA):	0-05
C.	Issuing Office:	EPA Office of Transportation and Air Quality (OTAQ) 2000 Traverwood Dr. Ann Arbor, Michigan 48105
D.	Contractor:	ICF International 9300 Lee Highway Fairfax, VA 22031-1207
E.	Statement of Work:	GHG Transportation Inventory Development
F.	Work Assignment Managers (WAM):	Venu Ghanta (202) 564-1374 ghanta.venu@epa.gov
	Alternate WAM	Edmund Coe (202) 564-8994 coe.edmund@epa.gov

BACKGROUND

The transportation sector is responsible for roughly 30 percent of greenhouse gas (GHG) emissions in the U.S., as well as the production of smog precursors, carbon monoxide (CO) and air toxics. Other impacts from transportation include noise and ecosystem disturbance. These effects are acknowledged through national legislation and other commitments, including:

- National Environmental Protection Act of 1969 (NEPA)
- Clean Air Act (CAA) Amendments of 1990
- Intermodal Surface Transportation Act of 1991 (ISTEA)
- Transportation Equity Act for the 21st Century (TEA-21)
- Climate Change Action Plan of 1993 (CCAP) and
- 1993 United Nations Framework Convention on Climate Change (UNFCCC).

EPA supports a range of analytic functions to demonstrate the environmental impacts of transportation. The U.S., with lead responsibility by EPA, is required the UNFCCC to report to the United Nations all U.S. emissions and sinks of GHGs. By mutual agreement with the Office of Atmospheric Programs (OAP), the Office of Transportation and Air Quality (OTAQ) has assumed responsibility for preparing estimates of GHG emissions for the transportation sector. Within OTAQ, the Transportation and Climate Division (TCD) manages this analysis. TCD also

supports EPA programs by examining the intersection of transportation policy, travel demand, vehicle engine technologies and energy consumption. Finally, TCD assists OTAQ and EPA in providing data and analysis to address the information requests of Congress, the Executive Branch, and the public.

OBJECTIVE

TCD's analytic work addresses the environmental impacts of transportation programs, policies and investments at all levels of government. This effort enhances the technical capacity of stakeholders in the fields of climate change analysis, air quality management, and transportation and urban planning.

TCD's analysis of transportation and climate change includes the development of an emissions inventory that identifies and quantifies the primary anthropogenic sources and sinks of U.S. GHG emissions (and corresponding baselines) from transportation sources. This analysis is then incorporated into a larger annual report, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2011 (April 2013) ("2011 Inventory Report"), as required under the United Nations Framework Convention on Climate Change (UNFCCC). The GHG transportation inventory must contain: (1) a comprehensive and detailed methodology for estimating sources and sinks of anthropogenic GHG emissions at levels sufficiently detailed to support policy decisions; and (2) represent a common and consistent source of information enabling OTAQ to compare the relative contribution of different GHG emission sources to climate change. The ability to estimate emissions systematically and consistently is a prerequisite for evaluating the cost-effectiveness and feasibility of GHG mitigation strategies.

TCD sponsors research examining transportation-related impacts on natural and human systems, with the objective of improving environmental analysis and informing policy development. This includes the estimation of emission factors to quantify mobile-source GHG and criteria output, as well as policy-sensitive models to forecast travel demand and energy consumption. Model results may be used to evaluate climate-related policy scenarios and guide EPA programs (such as SmartWay). Associated data and analysis may also be used to assist decision-making outside the agency, including the development of federal legislation, and the environmental initiatives of state and local governments. This information is available to broaden the scope of environmental planning and assist with planning requirements.

TASKS

Task 1: GHG Inventory Development for the Transportation Sector Required under UNFCCC

The contractor shall prepare the annual GHG emission inventory for the transportation sector portion of the 2011 Inventory Report. The inventory shall include estimates of carbon dioxide

(CO_2), methane (CH_4), Nitrogen Dioxide (N_2O) and hydrofluorocarbons (HFC) emissions from all mobile sources, including highway vehicles, aircraft, rail, watercraft, and non-road mobile sources. The inventory shall also include emissions of the following criteria pollutants: CO, NO_x, VOCs, and sulfur dioxide (SO_2). Estimates of these gases are to be obtained from the Office of Air Quality Planning and Standards (OAQPS).

The contractor shall perform Quality Assurance and Quality Control (QA/QC) and uncertainty analysis that complements the transportation sector analysis. Due to the complex nature of this part of the task, the EPA WAM will review and provide written technical direction as needed. The contractor shall build upon the 2011 Inventory Report document to improve on the estimation, documentation and reporting on uncertainties associated with both annual emission estimates and emission trends for the transportation inventory.

The contractor shall report transportation GHG/sink data in accordance with: (a) the required schedule for the 2011 Inventory Report required under UNFCCC and (b) the standard formats necessary to complete tasks for the 2011 Inventory Report as defined through written technical direction by the EPA Work Assignment Manager (WAM). Each submission of transportation-related data to Office of Atmospheric Programs (OAP) shall be approved by the WAM. The EPA WAM will provide the contractor with guidance regarding uncertainty analysis; QA/QC activities; and requirements for documentation, spreadsheet management, annexes, work breakdown structure (WBS), and report write-up.

The Contractor may be requested to provide additional analysis, research, and/or reports that support continued improvement of the transportation greenhouse gas inventory. Some additional analyses may be required to support those analyses conducted in support of developing the transportation sector portion of the *2011 Inventory Report* document. Such analyses will be initiated through written technical direction from the WAM.

Task 2: <u>Preparation of "2013 Fast Facts" Document</u>

The contractor shall prepare a summary report to be released publicly which summarizes emissions from the sources in the transportation sector. This summary report shall be prepared in a similar fashion to the "2012 GHG Fast Facts" document that was produced along with the *2011 Inventory Report*. This summary report shall convey the highlights from the current year's inventory in sufficient detail to be used by policymakers within the Office of Transportation and Air Quality, while also be understood by the general public.

DOCUMENTATION

The Contractor shall fully substantiate and document all of its work. No work under this work assignment shall be duplicated from previous efforts, studies, reports, or other sources. In order to avoid duplication of effort, the Contractor shall investigate existing literature and consult with the EPA WAM about any information the agency may have knowledge of prior to undertaking

any market research activities. Reports submitted by the Contractor that contain recommendations to EPA shall explain and rank policy or action alternatives, describe the procedure used to arrive at recommendations, summarize the substance of deliberations, report any dissenting views, list the sources used, and make clear the methods and considerations upon which the recommendations are based.

DELIVERABLES

1. Quality Assurance Project Plan (QAPP)

The contractor shall submit a draft QAPP to the EPA WAM within 14 days of work plan submission. The contractor shall describe the quality assurance procedures, quality control specifications, and other technical activities that must be implemented to ensure successful performance of tasks under this work assignment. Alternatively, the contractor may submit a Quality Assurance Supplement to their Quality Management Plan that includes all the required information for a QA Project Plan. The EPAWAM will review and comment on the draft QAPP. The contractor shall submit a final QAPP incorporating the recommended changes and suggestions received within 14 days of receipt of EPA comments. The QAPP shall meet all the requirements under the Contract.

2. Bi-weekly Progress Reports

In addition to monthly progress reports, the contractor shall provide the EPA WAM with brief bi-weekly progress reports via telephone conference or email during the period of performance. The progress report shall indicate the progress to date, technical problems encountered, solutions to those problems, and projected activity for the upcoming week.

3. GHG Inventory Development for the Transportation Sector

The contractor shall provide to the EPA WAM all spreadsheets related to updating the transportation sector portion of the 2011 Inventory Report, and any supplemental analyses that were conducted in support of the transportation sector 2011 Inventory Report analysis. Delivery format (e.g., Word, Excel) shall be indicated by the EPA WAM via written technical direction.

4. "2012 Fast Facts" Document

The contractor shall provide the 2012 Fast Facts document to the EPA WAM upon completion of Task 2. The WAM shall review and comment on this document. The contractor shall provide a revised version of the document within 14 days of receipt of the WAM's comments. Delivery format (e.g., Word, Excel) shall be indicated by the EPA WAM via written technical direction.

5. Draft Final Report and Final Report

The contractor shall provide a draft final report to the EPA WAM summarizing the results of all

the tasks under this work assignment within 14 days of completion of all tasks. The EPA WAM will review and comment on the draft final report. The contractor shall then submit a final report incorporating EPA suggestions and comments within 14 days of receipt of EPA comments. The deliverables shall include all spreadsheet related to updating the transportation sector portion of the 2011 U.S. Inventory of GHG Emissions and Sinks (April 2013), Fast Facts, and any supplemental analyses that were conducted in support of the transportation sector Inventory analysis.

SCHEDULE OF DELIVERABLES

Tasks	**Completion Date**
Draft QAPP Submission	Within 14 calendar days of Work Plan Submission
Final QAPP	Within 14 calendar days of receipt of EPA comments
GHG Inventory Development	September 15, 2012
2012 Fast Facts	September 15, 2012
Draft Final Report	September 15, 2012
Final Report	September 30, 2012

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-06

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2012	SmartWay Database Performance
	Base X Option Period Number	

Contractor	Specify Section and paragraph of Contract SOW
ICF INCORPORATED, L.L.C.	Tasks 2i and 7a

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 07/02/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 02/01/2012 To 09/30/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Kathleen Martz (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4335 FAX Number: 734-214-4906
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name: Jose Ortiz (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2831 FAX Number: 513-487-2109
Contracting Official Name: Sandra Savage (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2046 FAX Number:

Statement of Work

Contract EP-C-12-011 Work Assignment Number 0-06

Issuing Office
Environmental Protection Agency
2000 Traverwood Drive
Ann Arbor, MI 48105-2498

Contractor
ICF
9300 Lee Highway
Fairfax, VA 22031-1207

Title SmartWay Database Performance & Capabilities Assessment

Work Assignment Manager (WAM)
Kathleen A. Martz
734-214-4335
martz.kathleen@epa.gov

Alternate Work Assignment Manager
Chien Sze
734-214-4385
sze.chien@epa.gov

Period of Performance 7/2/2012 to 9/30/2012

I. BACKGROUND

The EPA Office of Transportation and Air Quality (OTAQ) is responsible for assessing and quantifying greenhouse gases (GHG) Carbon dioxide (CO_2), particulate matter (PM) and oxides of nitrogen (NO_x) emissions from mobile sources and promulgating regulations to control and reduce these emissions. SmartWay Transport Partnership, an OTAQ voluntary program that collaborates with the ground freight industry, has collected emissions data that contributed to the formation of the first standards to reduce GHGs and improve the fuel economy of heavy-duty vehicles. SmartWay was launched in 2004 with sixteen Charter Partners, has grown to approximately 3,200 hundred (June 2012) and due to its growing acceptance and popularity, is projected to grow to 50,000 in five years.

Freight movement data from Carrier, Shipper, Multi-modal, Logistics and Rail Partners in the program, is collected by SmartWay in Excel spreadsheets. Using these data, emissions are calculated in Excel Tools by formulas based on EPA's Motor Vehicle Emission Simulator (MOVES) data. These tools are downloaded from the SmartWay website, filled out by the Partner, and sent to EPA as an email attachment. Once at EPA, the Excel tool is manually converted to an .xml format and then uploaded manually by SmartWay personnel into the Oracle web database that uses ColdFusion programming language. This manual uploading is not practical for more than 5,000 partners, much less than the projected growth of 50,000 partners.

In July 2010, SmartWay transferred all of its stakeholders' data from its FileMaker Pro database (non-agency standard) to an Oracle (agency standard) database that is residing on a server on contractor premises in Lexington, MA. EPA is contemplating using a virtual server and relocating it to EPA's National Computer Center (NCC) in Research Triangle Park (RTP). This will allow EPA to avail itself of Central Data Exchange (CDX) services (web portal for outsiders to EPA) to protect the data and migrate to a web-based form with automatic database uploading in order to accommodate SmartWay's anticipated growth in partners with limited human resources.

EPA requires contractor support for a variety of technical analyses to determine the performance, efficiency and scalability of its database as it seeks to expand its outreach and increase the number of new partners by thousands annually, including migration to web application using web-based xml forms and CDX as its secure portal for data submissions.

II. OBJECTIVE

The main objective of this task is to conduct an independent assessment of the performance and capabilities of EPA's SmartWay Oracle database in its current state; the language it is written in, its parameters, its functionality, the efficiency of its architecture and readiness to handle the additional 50,000 in partner growth that is projected (scalability). The required deliverables under this work assignment include a plan for improvements, recommendations on the changes necessary and the level of complexity to convert to a web-based submission process, and an estimate of the costs involved for implementing a web-based process. The scope of this work is described in detail in the next section.

IV. SCOPE OF WORK

Task 1: Review and Assess Tools and Database

The EPA WAM will provide the contractor with copies of sample truck, multi-modal, rail, logistics and shipper tools and respective technical and user guides to become familiar with the tool design, calculation methods and data requested and then summarized by each tool.

The contractor shall assess all tools for clarity, usability (ease of use), efficiency of programming, speed and accuracy of calculations performed in the tools, and scalability. The contractor shall determine if the tools have been effectively optimized and integrated with SmartWay's Oracle database and capability for eventual automatic uploading operation with .xml files, including eventual xml web-based forms for submission functionality.

The contractor shall assess the Oracle database for scalability, use of sound and efficient programming logic, and effective use of state of the art programming methods. In addition, from the users' perspective the contractor shall assess search capabilities, resultant report interfaces, clarity of report text and definitions, functionality, ease of use, analysis capabilities, and integration of reports and/or graphs with the web site.

Task 2: Changes Required for the SmartWay Database

In the final report, the contractor shall outline specific recommendations to improve efficiency and scalability of the Tools and the database, web-based application security, and usability. In addition, the contractor shall discuss revisions to the current database that would be required for adaptation to web-based application with instant scanning of incoming Tools for viruses, review of Tools for out-of-range data, and uploading approvable Tools to the database.

V. DELIVERABLES

1. Quality Assurance Project Plan (QAPP)

The contractor shall submit a draft QAPP to the EPA WAM within 15 calendar days of Work Plan submission. The QAPP shall detail any and all data collection and analysis tasks and procedures for this work assignment. If the Work Plan entails no collection or analysis of environmental data, the contractor shall state so in the Work Plan. The EPA WAM shall review and comment on the QAPP. The contractor shall incorporate recommended changes and suggestions received before proceeding with technical work associated with the tasks below. A final QAPP shall be submitted within seven (7) calendar days after receipt of EPA comments. Information on completing a QAPP can be found at http://www.epa.gov/quality/at/extramural.html (general requirements) and /qatools.html (QMP/QAPP).

The final QAPP shall cover all aspects of this work assignment as outlined on the EPA Quality website. The QAPP shall have an appendix containing all applicable standard operating procedures (SOPs). The contractor shall adhere to all applicable SOPs and the QA procedures recommended therein. The contractor shall notify the EPA WAM immediately if they encounter anything that cannot be remedied, problems that may impact the quality, cost or on-time receipt of deliverables, or unavailability of items required for this work assignment.

2. Bi-Weekly Progress Reports

The contractor shall provide the EPA WAM with bi-weekly status reports via telephone conference or email during the period of performance. The progress report shall indicate the progress achieved in the concluded weeks, technical problems encountered, solutions to those problems, and projected activity for the upcoming weeks. Before proceeding with any solution to a problem, the contractor shall report the problem and consult with the EPA WAM concerning the scope of the solution. The bi-weekly progress report shall include an estimate of the percentage of each task completed to date, and the resources (level of effort and cost) expended on each task.

3. Draft and Final Reports.

The contractor shall provide to the EPA WAM a Draft Final Report and data set summarizing the result of all the tasks within 30 days of completion of the work defined in the tasks above, but no

later than September 5, 2012. The contractor shall incorporate EPA comments and deliver the Final Report within 15 days from the day that the EPA WAM delivers the reviewed draft report back to the contractor.

SCHEDULE OF DELIVERABLES

Tasks	**Completion Date**
Draft QAPP Submission	Within 15 calendar days of Work Plan submission
Final QAPP	Within 7 calendar days of receipt of EPA comments
Bi-weekly progress reports	On-going
Draft Final Report	September 5, 2012
Final Report	Within 15 days of receipt of EPA comments or September 30, 2012

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-07

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2012	Aerosol Generator
	Base X Option Period Number	

Contractor	Specify Section and paragraph of Contract SOW
ICF INCORPORATED, L.L.C.	Task 3(b,c,d); Task 7

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 07/03/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 02/01/2012 To 09/30/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Bob Giannelli (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4708 FAX Number:
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name: (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Sandra Savage (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2046 FAX Number:

PERFORMANCE WORK STATEMENT

A.	EPA Contract:	EP-C-12-011
B.	Work Assignment (WA):	0-07
C.	Issuing Office:	EPA Office of Transportation and Air Quality (OTAQ) 2000 Traverwood Dr. Ann Arbor, Michigan 48105
D.	Contractor:	ICF International 9300 Lee Highway Fairfax, VA 22031-1207
E.	Statement of Work:	Continuation of the Development of an Aerosol Generator for Use as a Calibration and Test Standard
F.	Work Assignment Managers (WAM)	Dr. Bob Giannelli 734-214-4708 giannelli.bob@epa.gov
	Alternate WAM	Christine Brunner 734-214-4287 brunner.christine@epa.gov

I. BACKGROUND

Over the past several years, the Environmental Protection Agency (EPA) has developed an aerosol or particulate matter (PM) generator that has been used in developing measurement allowances for emissions from heavy-duty in-use diesel engines. This system was designed to produce aerosols that mimic the characteristics of those emitted from combustion sources that use hydrocarbon-based fuels. The PM generator is designed to finely control the aerosols by chemical species, concentration, particle number and size distribution. It was envisioned to produce a wide spectrum of carbon-based, hydrocarbon-based, sulfate-based and nitrate-based aerosols that are known to be emitted from internal combustion engines. Figure 1 is an illustrative example of the mix of these aerosols emitted from a mid-1990's (non-trapped) diesel engine and their relationship to the chemical (carbon-based) species contained in diesel fuel from J.J. Schauer, et al.[1] Using the PM generator, the measurement characteristics of a PM sampling system and the instrument that measures particulate matter mass and/or Particle Number (PMn) emissions from a combustion engine can be better quantified in terms of the particular species and size of the PM that is being measured.

[1] J.J. Schauer, M.J. Kleeman, G.R. Cass, and B.R.T. Simoneit, Environmental Science and Technology, vol 33, pp1578ff, 1999

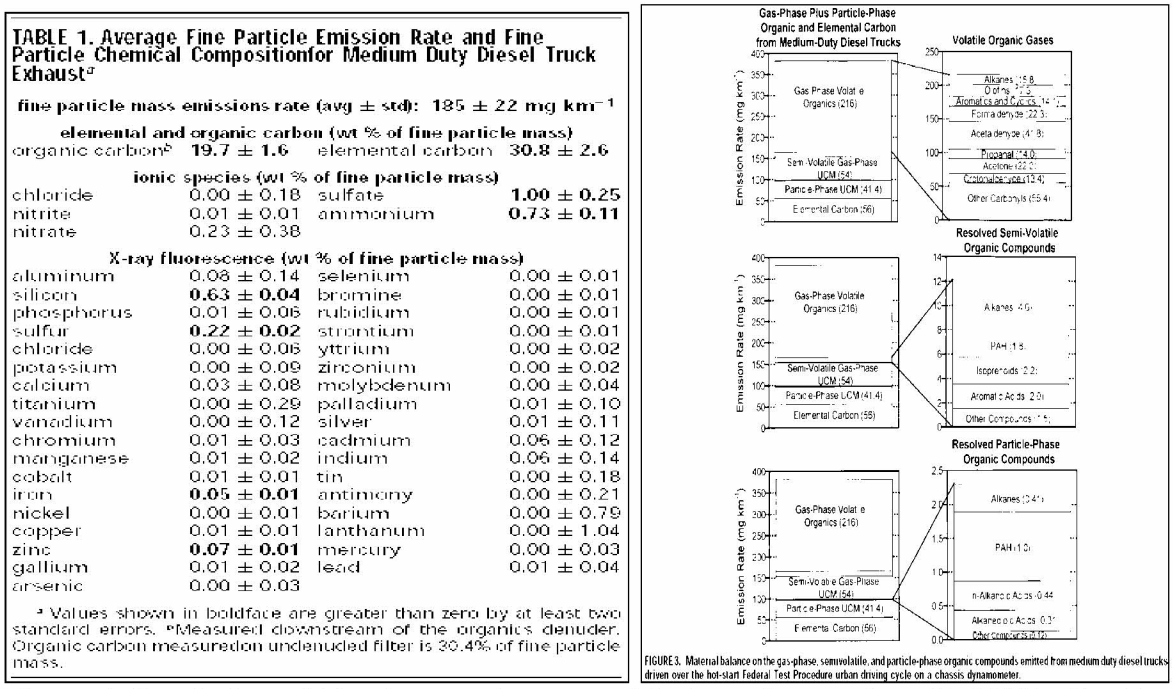

TABLE 1. Average Fine Particle Emission Rate and Fine Particle Chemical Compositionfor Medium Duty Diesel Truck Exhaust[a]

fine particle mass emissions rate (avg ± std): 185 ± 22 mg km^{-1}

elemental and organic carbon (wt % of fine particle mass)			
organic carbon[b]	**19.7 ± 1.6**	elemental carbon	**30.8 ± 2.6**

ionic species (wt % of fine particle mass)			
chloride	0.00 ± 0.18	sulfate	**1.00 ± 0.25**
nitrite	0.01 ± 0.01	ammonium	**0.73 ± 0.11**
nitrate	0.23 ± 0.38		

X-ray fluorescence (wt % of fine particle mass)			
aluminum	0.08 ± 0.14	selenium	0.00 ± 0.01
silicon	**0.63 ± 0.04**	bromine	0.00 ± 0.01
phosphorus	0.01 ± 0.06	rubidium	0.00 ± 0.01
sulfur	**0.22 ± 0.02**	strontium	0.00 ± 0.01
chloride	0.00 ± 0.06	yttrium	0.00 ± 0.02
potassium	0.00 ± 0.09	zirconium	0.00 ± 0.02
calcium	0.03 ± 0.08	molybdenum	0.00 ± 0.04
titanium	0.00 ± 0.29	palladium	0.01 ± 0.10
vanadium	0.00 ± 0.12	silver	0.01 ± 0.11
chromium	0.01 ± 0.03	cadmium	0.06 ± 0.12
manganese	0.01 ± 0.02	indium	0.06 ± 0.14
cobalt	0.01 ± 0.01	tin	0.00 ± 0.18
iron	**0.05 ± 0.01**	antimony	0.00 ± 0.21
nickel	0.00 ± 0.01	barium	0.00 ± 0.79
copper	0.01 ± 0.01	lanthanum	0.00 ± 1.04
zinc	**0.07 ± 0.01**	mercury	0.00 ± 0.03
gallium	0.01 ± 0.02	lead	0.01 ± 0.04
arsenic	0.00 ± 0.03		

[a] Values shown in boldface are greater than zero by at least two standard errors. [b]Measured downstream of the organics denuder. Organic carbon measuredon undenuded filter is 30.4% of fine particle mass.

FIGURE 3. Material balance on the gas-phase, semivolatile, and particle-phase organic compounds emitted from medium duty diesel trucks driven over the hot-start Federal Test Procedure urban driving cycle on a chassis dynamometer.

Figure 1. Speciation of diesel aerosol measured in the exhaust of a mid 1990's diesel engine from Schauer, et al., 1999.

Currently, the aerosol generator is in its second construct. The original design[2] has been revised to the configuration shown in Figure 2. The EPA aerosol generator system is comprised of:

1) Mini-Cast carbon aerosol generator[3]combined with a hydrocarbon stripper to provide non-volatile carbon core particulates in the size range from 5 to 500nm that serve as condensation and adsorption sites for the volatile constituents (see sections Ia – Id in Figure 2).

2) Permeation tubes for generation of the PM precursor hydrocarbons with carbon numbers from 13 to 36 (labeled HCS in section II of Figure 2).

3) Humidified sulfuric acid source consisting of SO_2 gas source, catalyst for SO_2 to SO_3 conversion, and H_2O source (labeled SO_3S in section II of Figure 2).

4) Generated aerosol constituents are diluted and transported via heated transport lines to a heated manifold using dry filtered nitrogen (N_2) as a carrier gas (labeled MC in section II of Figure 2).

[2] See D.R. Booker and B. Avimukta, Semtech-PM Generator Design Report, Sensor's, Inc., 2006.
[3] See http://www.sootgenerator.com/midCAST_g.htm

5) From the manifold, the aerosol mixture is transported via heated transport lines to a dilution system (steady-state dilution ratio range of 5:1 to 20:1) where the generated sample's concentration and temperature are adjusted before being transported to the sampling system (section III of Figure 2).

6) Sampling system temperature controlled to 250°C.

7) Diagnostic instrument suite.

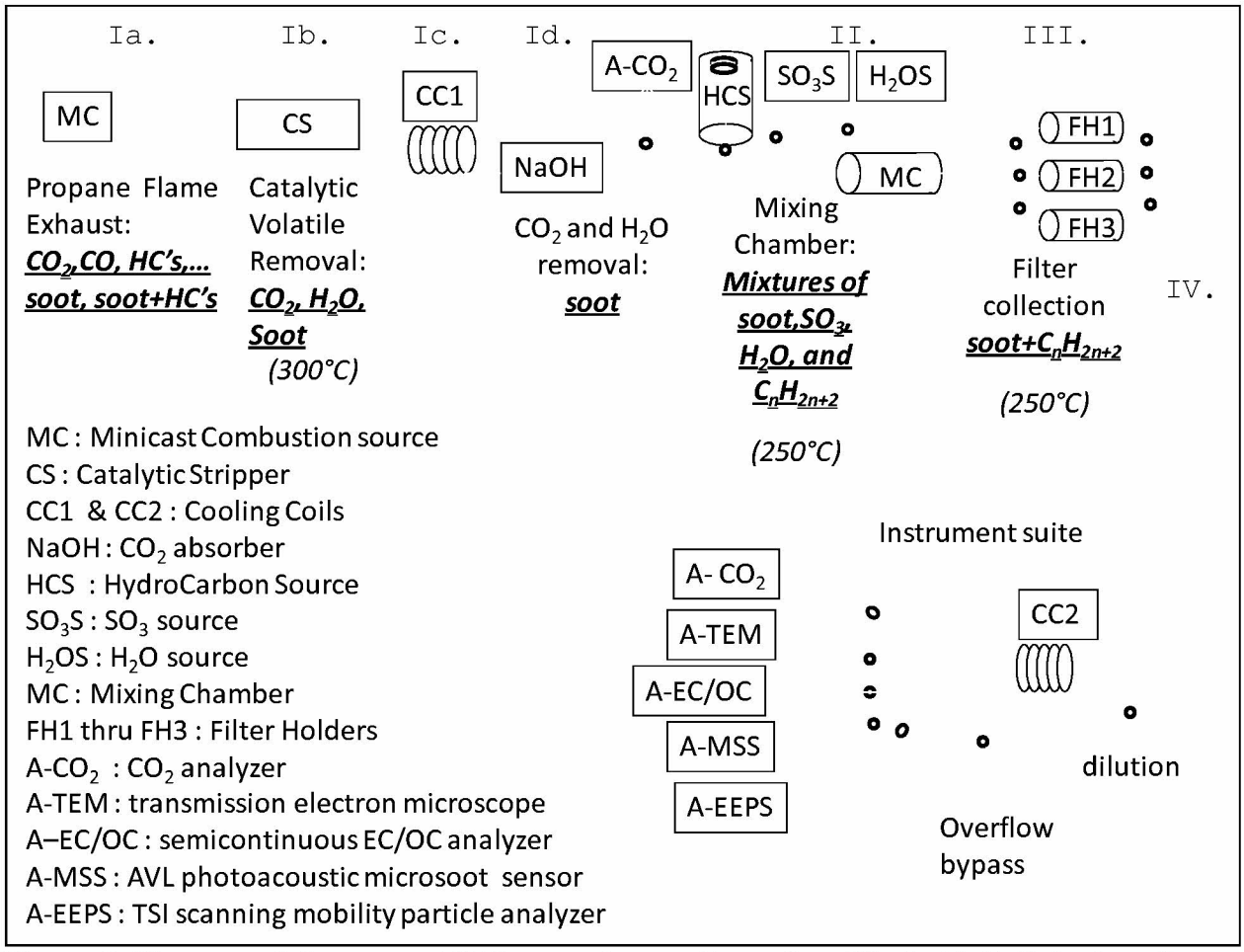

Figure 2. Diagram of the current PM generator configuration. The bold, italicized, and underlined text indicates the chemical species present in a particular element of the PM generator. The sections are delimited with the dashed lines and numbered with the Roman numerals.

In the process of developing the aerosol generator, a model of the permeation process was developed that permitted quantitative prediction of emission rates as a function of oven temperature and pressure. Particle losses (thermo-phoretic, diffusional, etc.) in the sample lines

can be made from standard transport loss models.[4]] In addition, hydrocarbon phase partitioning models are used to quantitatively predict aerosol growth and loss processes such as condensation, adsorption and aggregation that can take place in the sample manifold, transport lines, and secondary diluter. These include adsorption and absorption equilibrium models such as Langmuir single layer[5], BET multi-layer[6], macroscopic volatility binning, and linear free energy relationship (LFER) Gibbs free energy minimization[7]between sorbate and sorbent.

II. OBJECTIVE

The aerosol generator has proven to provide stable concentrations of both soot aerosols and aerosols with a combination of soot and volatile components. With this system, the EPA is interested in having the contractor conduct experiments to determine what effects the sampling system and measurement instrument have on the characteristics of the particulate mass (PMm) and particulate number (PMn) being measured. This work is in support of the development of future test procedures for the measurement of total PMn. Specifically, this work should provide the data necessary to evaluate the performance of phase partitioning and loss models which may be used to select the thermodynamic and other sampling conditions for a future laboratory PMn measurement procedure. The procedure shall include all PMm components (elemental carbon, OC, ions, etc.) and shall reflect the characteristics of freshly diluted exhaust that has been emitted along a roadway. This work shall aim to identify the source of any sampling artifacts (both positive and negative).

III. SCOPE OF WORK

The Contractor shall provide support in the following task areas:

Task 1: Evaluate Simplified Sampling System

Typical PMm and PMn sampling systems contain the following two main components: a raw exhaust diluter and transport tubing that transports the diluted sample to one or more measurement instruments.

Sub-Task 1a: Test matrix: The contractor shall design a test matrix to quantify the source emissions rates for a number of conditions that represent the range of concentrations and

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[4] E.g., aerocalc, (P.Baron), UTRC Particle Transport Tool User (H.Hollick and D.Liscinsky), Particle Loss Calculator (S.-L. von der Weiden, F. Drewnick, and S. Borrmann Schlichting), and text references, H.Schlichting, Boundary Layer Theory, Springer-Verlag, 2000., Perry, R.H.; Green, D.W. Perry's Chemical Engineers Handbook Seventh Edition,McGraw Hill, 1997., Bird, R.B.; Stewart, W.E.; Lightwood, E.N. Transport Phenomena, JohnWiley and Sons, 2007., Fuchs, N.A.; The Mechanics of Aerosols, Pergamon Press,1964.,Gormley, P.G.; Kennedy M. Proc. Royal Irish Acad. 1949, 52A, 163-169., Graetz, L. Ann.Physik 1883, 18, 79., Nusselt,W. Z.Ver.Deutsch. Ing. 1910, 54, 1154., Townsend, J. Phil. Trans.1900, 193, 129, and Lapple, C.E.; Stanford Research Institute Journal 1961, 5, 95.

[5] See I. Langmuir, J. Am. Chem. Soc. 38, pp2221-95, 1916.

[6] See S. Brunauer, P.H. Emmett, and E. Teller, J. Am.Chem. Soc. 60, p309, 1938.

[7] See http://goldbook.iupac.org/L03551.html

volatilities of species found in freshly diluted internal combustion engine exhaust. The contractor shall consider a number of soot concentrations and a number of individual hydrocarbon volatilities and a number of dilution ratio, flow rate, and temperature conditions. To avoid confounding results, it is recommended that the test matrix evaluate approximately five different hydrocarbons spanning the 95% gas to 95% PMm range of volatility (for the conditions tested), but only one pure hydrocarbon should be emitted at a time.

Sub-Task 1b: Evaluate Sampling System. For each condition of the test matrix from sub-task 1a, the contractor shall analyze the mass of PM and sorbed species collected by the analytical technique(s) and by the sampling system itself.

Sub-Task 1c: Status report: The contractor shall provide a brief (e.g., less than 5-page) summary of the results and the data in support of the results of Task 1.

Task 2: Sampling for cryo-Transmission Electron Microscopy (TEM) and High Resolution Transmission Electron Microscopy (HRTEM) analyses

To develop the Jing minicast and catalytic stripper combination soot output operational parameters for the diesel engine-like, extended aggregate particles, the contractor shall conduct PM sampling for cryo-TEM analyses.

In a previous TEM analysis of soot production by the Jing minicast and catalytic stripper combination, the soot was found to be comprised of extended and compact aggregate particles. The extended aggregate soot particles are more representative of diesel engine exhaust soot. Additionally, the opacity levels of the TEM images indicate differing chemical composition of the soot.

Sub-Task 2a: TEM AND HRTEM analyses: The contractor shall conduct sampling with a high resolution (sub-nanometer/ angstrom scale) transmission electron microscope (HRTEM) to possibly resolve the chemical species for these differing soot opacity levels as seen by the nanometer scale TEM.

a.) The contractor shall conduct a survey study of the Jing minicast and catalytic stripper combination soot output to determine the range of operational parameters (oxygen to fuel ratio, flame temperature, and pressure) at which the extended aggregate particles are produced. This survey study will cover a wide range of possible operational parameters for the Jing minicast and catalytic stripper combination. This can be done with a TEM sampling technique that does not sample uniformly over the entire size distribution.
b.) The contractor shall use the Jing minicast and catalytic stripper combination operational parameters determined in a.) above to conduct a more refined study of the operational parameters for soot production with a TEM with a sampling technique that samples the soot particles more uniformly over the particle size range. In this study, the range of operational parameters shall be better defined and in a more limited range. More time can be spent collecting data that helps define the operational parameters to a well resolved, finite range.

c.) The contractor shall study the soot morphology with a high resolution (sub-nanometer/ angstrom scale) transmission electron microscope (HRTEM) to better characterize the differing opacity levels of the soot observed with the current nanometer scale resolution TEM being used in a.) and b.) above. The differing opacity levels are an indication that the soot is composed of more than simply layered graphitic lattices.

Sub-Task 2b: Status report: The contractor shall provide a brief (e.g., less than 5-page) summary of the results and the data in support of the results of Task 2.

Tasks 3 and 4 shall be initiated upon receipt of written technical direction from the EPA WAM.

Task 3: Characterize sulfuric acid generation system and repeat Task 1 and 2 with Sulfuric Acid

The contractor shall characterize the range of PM mass and size distributions generated by the sulfuric acid nucleation system and then repeat Task1b. The contractor may need to develop a different sampling and analytical technique versus the system developed for Task 1.

Sub-Task 3a: The sulfuric acid precursor, SO3, is produced through catalysis of SO_2 with O. The contractor shall monitor the SO_3 production by using an SO_2 analyzer downstream of the catalytic cell

Sub-Task 3b: Status report: The contractor shall provide a brief (e.g., less than 5-page) summary of the results and the data in support of the results of Task 3.

Task 4: Inverse Gas Chromatography

The contractor shall select a number of transport tubing materials, soots, and semi-volatile hydrocarbons for Inverse Gas Chromatography analysis to determine the surface energies and solvation energies of these materials. The materials shall be analyzed to determine both their polar and non-polar net attractive forces, which govern the sorption mechanisms under investigation (i.e., adsorption and absorption).

Sub-Task 4a: The contractor shall consult with technical experts and subcontractors as needed to develop appropriate sample preparation and sampling techniques to prepare the samples for inverse gas chromatography analyses. The contractor shall ensure sufficient repeat analyses to ascertain statistical significance ($\leq$10% variability) of the results.

Sub-Task 4b: The contractor shall conduct sampling and sampling preparation for inverse chromatography analyses.

Sub-Task 4c: Status report: The contractor shall provide a brief (e.g., less than 5-page) summary of the results and the data in support of the results of Task 4.

IV. DELIVERABLES

1. Quality Assurance Project Plan (QAPP). The contractor shall submit a draft QAPP to the EPA WAM within 10 days of Work Plan submission. The QAPP shall detail data collection and analysis tasks and procedures for this work assignment. The EPA WAM shall review and comment on the QAPP. The contractor shall incorporate recommended changes and suggestions received before proceeding with technical work associated with this work assignment. A final QAPP shall be submitted within 15 days after receipt of EPA comments. Information on completing a QAPP can be found at http://www.epa.gov/quality/at/extramural.html (general requirements) and Iqatools.html *(QAPP).*

The final QAPP shall cover all aspects of this test program as outlined on the EPA quality website. The QAPP shall have an appendix containing all applicable standard operating procedures (SOPs). The contractor shall adhere to all applicable SOPs and the QA procedures recommended therein.

2. Bi-Weekly Progress Reports. The contractor shall provide the WAM with brief bi-weekly status reports via telephone conference or email during the period of performance. The progress report shall indicate the progress achieved in the concluded weeks, technical problems encountered, solutions to those problems, and projected activity for the upcoming weeks. Before proceeding with any solution to a problem, the contractor shall report the problem and consult with the EPA WAM concerning the scope of the solution. The bi-weekly progress report shall also include an estimate of the percentage of each task completed to date, and the resources (level of effort and cost) expended on each task.

3. Technical Reports. The contractor shall provide EPA WAM with a brief Technical Report upon completion of each task, where specified. Depending on the complexity of the subject matter, the EPA WAM will provide written technical direction on whether these reports shall be in the form of a presentation or a formal written document. Written products shall be delivered in formats specified by the EPA WAM (e.g., Word, Excel).

4. Data. The contractor shall provide to the EPA WAM test and modeling data that supports the results of all the tasks within 45 days of completion of the laboratory and modeling work defined in the Tasks above.

5. Final Report. The contractor shall provide to the EPA WAM a draft final report summarizing the results of all the tasks within 30 days of completion of the laboratory and modeling work defined in the Tasks above. The contractor shall deliver the final report within 15 days from the day that the EPA WAM has delivered the reviewed draft report back to the contractor.

6. Final Presentation. The contractor and/or key sub-contractors shall travel to EPA's Office of Transportation and Air Quality (OTAQ), 2000 Traverwood Dr., Ann Arbor, Michigan 48105, for a one-day meeting to present key findings and to conduct a question and answer meeting to inform OTAQ technical experts of the results and conclusions of this work.

Schedule of Deliverables

Steps	**Completion Date**
QAPP Submission	Within 10 calendar days of Work Plan submission
Final QAPP	Within15 calendar days of receiving EPA comments
Complete all Tasks 1 and 2	September 30, 2012
Tasks 3 and 4 – Technical Reports	Within 15 days of completion of tasks
Draft Final report	Within 30 days of completion of all tasks
Final report	Within 15 calendars days of receiving EPA comments
Final presentation	Within 45 days of completion of final report

NON-DISCLOSURE AGREEMENT

All documentation acquired and/or provided by EPA or generated as a result of this project shall be under the control of the U.S. EPA Assistant Administrator for Air and Radiation, or his or her designated representative, and shall not be released by the Contractor to any other source without specific approval by U.S. EPA.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-08

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2012	Travel Efficiency Assessment M
	Base X Option Period Number	

Contractor	Specify Section and paragraph of Contract SOW
ICF INCORPORATED, L.L.C.	Task 7a

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 07/03/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 02/01/2012 To 09/30/2012 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: David Bizot (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4432 FAX Number:
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name: Jose Ortiz (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2831 FAX Number: 513-487-2109
Contracting Official Name: Sandra Savage (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2046 FAX Number:

STATEMENT OF WORK

Work Assignment (WA):	0-08 (EP-C-12-011)
Title:	Travel Efficiency Assessment Methodology GHG and Criteria Emissions Case Studies Preparation and Model Evaluation
Contractor:	ICF International 9300 Lee Highway Fairfax, VA 22031-1207
Work Assignment Manager: (WAM)	David Bizot 2000 Traverwood Drive Ann Arbor, MI 48105 Phone: 734-214-4432 Fax: 734-214-4052 Email: bizot.david@epa.gov
Alternate WAM:	Astrid Larsen 2000 Traverwood Drive Ann Arbor, MI 48105 Phone: 734-214-4812 Fax: 734-214-4052 Email: larsen.astrid@epa.gov
Period of Performance:	July 3, 2012 to September 30, 2012

BACKGROUND

The Transportation and Climate Division (TCD) of EPA's Office of Transportation and Air Quality (OTAQ) provides analysis, guidance and technical assistance on transportation policy and program effects on mobile source emissions and air quality to Federal, State, and local agencies and governments. These stakeholders are increasingly interested in evaluating the effectiveness of travel efficiency (TE) and other related strategies for reducing criteria, precursor emissions, and greenhouse gases (GHGs). In March 2011, TCD published a report titled *Potential Changes in Emissions Due to Improvements in Travel Efficiency*. This report outlines a peer reviewed methodology for evaluating the emission benefits of travel efficiency strategies, and will serve as a guide for conducting the case studies described in this work assignment.

OBJECTIVE

The objective of this work assignment is to help EPA prepare to conduct future GHG planning and TE assessment case studies using the Travel Efficiency Assessment Methodology (TEAM). These future case studies will integrate the use of transportation/land-use sketch models and EPA's Motor Vehicle Emissions Simulator (MOVES) emissions model to demonstrate: (1) how this method can be used cost-effectively to create inventories of on-road GHG and criteria emissions, and (2) the feasibility of scenario analysis as a useful source of information on the effectiveness of travel efficiency strategies for reducing travel activity and emissions. While sketch tools are not a substitute for traditional comprehensive transportation, land-use, and air quality modeling, they can serve an important role by allowing local officials to analyze travel efficiency strategies, such as pricing, land-use, and transit, which cannot easily be modeled with traditional approaches.

The first task in this WA is to support EPA in identifying and recruiting state or local areas to be potential participants in future case studies. The second task is to evaluate the MOVES emission factors incorporated in the Trip Reduction Impacts of Mobility Management Strategies (TRIMMS™) model for consistency with EPA guidance. These tasks will help prepare EPA to complete the actual case studies with candidate areas at some future date.

TASK 1: RECRUITMENT OF LOCAL AREAS FOR FUTURE TEAM CASE STUDIES

The contractor shall assist TCD in recruiting 2-4 medium to large (above 200,000 population in the MSA) metropolitan areas as candidates to participate in potential future TEAM case studies. The contractor shall draft a one to two page project description summarizing the purpose of the project, the fundamental steps in working with the selected metropolitan areas, and the approach to the analysis.

The contractor shall identify and prepare a draft list of metropolitan area candidates with high potential for participation in the project and the contact information for transportation and air quality planning agency staff for the areas. The contractor shall draft a notice that requests letters of interest from the potential participating areas, including criteria for participation. The EPA WAM will provide the list of criteria to the contractor. The criteria may include, but not be limited to, past participation in similar projects, availability of appropriate travel activity, land use, and transportation emissions data, collaboration between multiple regional/State planning agencies, and adequate availability of staff and desire to assist in the completion of the project within the project period. EPA WAM will issue the notice requesting letters of interest and will provide the contractor with the responses. The contractor shall then prepare a preliminary ranking of the metropolitan areas that submitted letters of interest, based upon their responses.

The contractor shall host a conference call with the EPA WAM to discuss the preliminary rankings and the pros and cons of the identified metropolitan areas. At the written technical direction of the EPA WAM, the contractor shall create a list of the metropolitan areas, and the agencies that would be invited to participate in the project.

Deliverables (Schedule)
Draft list of potential local area candidates, letter, and one page project description (Aug. 17, 2012)
Final list of potential local area candidates, letter, and one page project description (Sept. 7, 2012)
Preliminary rankings of potential local area candidates, including list of local agencies for top candidates (Sept. 21, 2012)

TASK 2: EVALUATION OF MOVES EMISSION FACTORS IN TRIMMS
The contractor shall evaluate and document whether the MOVES emission factors estimated by the developers of the TRIMMs model (a transportation sketch planning model developed by the University of South Florida), and incorporated into the TRIMMs model were developed using a method consistent with existing OTAQ MOVES guidance. The EPA WAM shall provide EPA's MOVES guidance for estimating emissions of criteria and GHG pollutants. Utilizing this guidance and the publicly available technical documentation for the TRIMMs model, the contractor shall evaluate how the developers of TRIMMs estimated the emission factors that they incorporated into the TRIMMs model. The contractor shall describe how the emission factors incorporated into TRIMMs were estimated, including the methodology and assumptions about vehicle fleet, fuels, travel activity and environmental characteristics and whether the methodology and assumptions are consistent with EPA MOVES guidance. The contractor shall describe any inconsistencies found with respect to the MOVES guidance and how the methodology and assumptions used affect emissions estimates used with TRIMMS. A draft technical memorandum containing the results of this evaluation shall be submitted to the EPA WAM for review and comment. The contractor shall revise the draft technical memorandum per the direction of the EPA WAM and submit a final technical memorandum within 10 days of receiving comments from EPA.

Deliverables (Schedule)
Draft memorandum containing results of TRIMMS evaluation (Aug. 31, 2012)
Final memorandum containing results of TRIMMS evaluation (Sept. 28, 2012)

CONSOLIDATED DELIVERABLES AND SCHEDULE

Deliverable(s)	Schedule/Due Date
Task 1: Draft list of potential local area candidates, letter, and one page project description	Aug. 17, 2012
Task 1: Final list of potential local area candidates, letter, and one page project description	Sept. 7, 2012
Task 1: Preliminary rankings of potential local area candidates	Sept. 14, 2012
Task 2: Draft memorandum containing results of TRIMMS evaluation	Aug 31, 2012
Task 2: Final memorandum containing results of TRIMMS evaluation	Sept. 28, 2012

DISTRIBUTION AND FORMAT OF DELIVERABLES

The contractor shall deliver all work assignment deliverables, including status reports and interim products, in an appropriate electronic format (e.g., Microsoft Word, Excel, Acrobat). This applies to all tasks under this work assignment unless otherwise specified in written technical direction by the EPA WAM.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-09

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2012	Multi-media modeling of lead f
	Base X Option Period Number	

Contractor	Specify Section and paragraph of Contract SOW
ICF INCORPORATED, L.L.C.	Tasks 6b and 6f

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 07/02/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 02/01/2012 To 09/30/2012 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Meredith Pedde (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4748 FAX Number:
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name: Jose Ortiz (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2831 FAX Number: 513-487-2109
Contracting Official Name: Sandra Savage (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2046 FAX Number:

STATEMENT OF WORK

A. Work Assignment:	0-09
B. EPA Contract:	EP-C-12-011
C. Issuing Office:	Environmental Protection Agency
D. Contractor:	ICF International 9300 Lee Highway Fairfax, VA 22031-1207
E. Statement of Work Title:	Multi-media modeling of lead from agricultural use of piston-engine aircraft.
F. Work Assignment Manager (WAM):	Meredith Pedde Tel: 734-214-4748 Fax: 734-214-4939 Email: pedde.meredith@epa.gov
Alternate WAM:	Rich Cook Tel: 734-214-4827 Email: cook.rich@epa.gov
G. Period of Performance:	July 2, 2012 – September 30, 2012

BACKGROUND

Tetraethyl lead is added to aviation gasoline (avgas) which is used in most piston-engine powered aircraft. Lead (Pb) emissions from the use of leaded aviation gasoline accounts for approximately half the air emission inventory for lead. In October 2006, EPA received a petition from Friends of the Earth (FOE) requesting that the Agency find that aircraft lead emissions may reasonably be anticipated to endanger the public health or welfare, and to take action to control lead emissions from piston-engine aircraft. FOE also requested that if there was insufficient information, the EPA should commence a study of the issue. The intent of this work is to continue EPA's investigation and study of lead emitted by piston-engine aircraft and the potential impact on public health and welfare.

The purpose of the multi-media modeling described in this work assignment is to evaluate the potential range of concentrations of lead in food products that is attributable to lead emitted by piston-engine aircraft in the agricultural industry. Atmospheric deposition of lead is estimated to comprise a significant proportion of lead in food (AQCD for Lead, p. 3–48) and dietary intake may be a predominant source of lead exposure (73 FR 66971).

The agricultural aviation industry treats 71 million acres of cropland each year out of the 408 million acres of cropland in the United States.[1] According to a 2011 survey conducted by the National Agricultural Aviation Association, aviation is used most frequently to treat alfalfa, rice and cotton. In addition to those crops, aviation is also used in the cultivation of grapes, lettuce, spinach, carrots and other crops for human consumption. There are over 3.3 million acres of land used to grow rice in the U.S.[2] Aircraft are used in multiple stages of the production of rice including seeding (in California), nutrient applications, pesticide and fungicide applications, and in some cases, application of desiccants. Consequently, a single crop can experience over-flights by piston aircraft multiple times during one growing season.

The Federal Aviation Administration's (FAA) General Aviation and Air Taxi Activity Survey (GAATA) collects information on the number of hours and aircraft flown for purposes of aerial application in agriculture and forestry[3]. In 2010, the GAATA reports that 461,439 hours were flown by 1,439 aircraft for the purpose of aerial application in agriculture and forestry, the majority of which (86%) were conducted by fixed wing piston aircraft.[4] Using these data, EPA estimates that approximately 13 tons of lead was emitted by aircraft during aerial application in agriculture and forestry in the U.S. in 2010.

Lead dibromide, the primary form of lead emitted by engines operating on leaded fuel, is slightly water soluble and will therefore enter the water column, which may be particularly important for crops such as rice, which are grown in water. In addition, metals that are applied to soil as salts (usually as sulfate, chloride, or nitrate salt) are accumulated more readily than the same quantity of metal added via sewage sludge, flue dust, or fly ash (AQCD for Lead, Section 2.3.7). Lead halides may also be more readily absorbed by plants than other forms of inorganic lead.

Depending on wind conditions, an aircraft involved in aerial application may fly only 4 inches to 12 feet above the crops.[5, 6, 7] The low flying height is needed to minimize the drift of the fertilizer and pesticide particles away from their intended target. An unintended consequence of this practice is that exhaust emissions of lead have a substantially increased potential for directly depositing on vegetation and surrounding soil.

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[1] National Agricultural Aviation Association http://www.agaviation.org/content/facts-about-aerial-application-industry accessed 16 April 2012.

[2] National Agricultural Aviation Association http://www.agaviation.org/content/changes-rice-production-mean-longer-days-aerial-applicators. U.S. farmers raise rice on more than 3.3 million acres spread among six regions: Arkansas's Grand Prairie; the Mississippi River Delta; California's Sacramento Valley; northeastern Arkansas and Missouri's "boot heel"; the Coastal Prairie of Texas; and southwest Louisiana

[3] FAA describes aerial application in agriculture and forestry as crop and timber production, including fertilizer and pesticide application.

[4] FAA GAATA available at: http://www.faa.gov/data_research/aviation_data_statistics/general_aviation/CY2010/

[5] Xiong, Chao. (9-23-2007) "Future for Crop Dusters is up in the Air". The Star Tribune. Retrieved on August 12, 2009 from: http://www.startribune.com/local/11606661.html

[6] Harpole, T. (3-1-2007) "That Old-Time Profession" Air & Space Magazine. Retrieved on August 12, 2009 from: http://www.airspacemag.com/history-of-flight/old_time_profession.html

[7] Petersen, R. "So you want to be a spray pilot". AgAir Update. Retrieved on October 9, 2009 from: http://www.agairupdate.com/aau/wannabe/pilot.html

Once entrained in soil, most lead is retained via the formation of stable solid phase compounds, precipitates, or complexes with organic matter. Thus, terrestrial ecosystems remain primarily sinks for lead but amounts retained in various soil layers vary based on forest type, climate, and litter cycling (AQCD for Lead, Section 7.1). Once in the soil, the migration and distribution of lead is controlled by a multitude of factors including pH, precipitation, litter composition and other factors, which in turn, govern the rate at which lead is bound to organic materials in the soil (AQCD for Lead, Section 2.3.5, and Section AX 7.1.4.1).

Plants take up lead via their foliage and through their root systems. The rate of plant uptake from soil varies by plant species, soil conditions, and lead species. Most lead in plants is stored in roots, and very little is stored in fruits. Surface deposition of lead onto plants may represent a significant contribution to the total lead in and on the plant, as has been observed for plants near smelters and along roadsides (AQCD for Lead, page E-19). Atmospheric deposition of lead also contributes to lead in vegetation as a result of contact with above-ground portions of the plant (AQCD for Lead, pp. 7–9 and AXZ7–39; USEPA, 1986, Sections 6.5.3 and 7.2.2.2.1).[8]

EPA has not identified any data or analyses regarding the contribution of piston-engine aircraft lead emissions to lead concentrations in or on plant tissues or the dose that this use of piston-engine aircraft might deliver to the human population. We sought comment on the potential significance of this exposure pathway in our Advance Notice of Proposed Rulemaking in April 2010 and received no information and are thus undertaking this work assignment to understand the potential range in concentrations in food products that might result from lead emitted by piston-engine aircraft used in an agricultural setting.

TASKS

In this work assignment, up to four types of crops shall be evaluated via modeling to understand the potential range of lead concentrations attributable to lead emissions from piston aircraft used in the cultivation of these crops: a root vegetable, a leafy vegetable, a grain and a fruit (e.g., carrot, spinach, rice and grapes). The output expected from this work assignment is an evaluation of the possible range of lead concentrations in these different crops based on a range of reasonable inputs for this multi-media evaluation. These inputs include: ambient air concentrations, deposition rates (including direct deposition to the leaf or other plant parts that are consumed as well as soil or water substrate in which the plant is growing), accumulation of lead from aircraft emissions in soil over the years of aviation use for a given plot of land, uptake of aviation lead into the crop and the distribution of that lead in the plant (e.g., root, leaf, grain, fruit).

EPA recognizes that there are many areas of uncertainty in conducting this modeling effort. Through this work assignment, EPA is seeking to understand the potential range of concentrations of lead in crops from the use of piston aircraft in agriculture. The Contractor shall complete Tasks 2 and 3 for one crop (e.g., spinach or grapes), as provided in written

[8] U.S. Environmental Protection Agency (1986) Air quality Criteria for Lead. Research Triangle Park, NC: Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office; EPA report no. EPA-600/8-83/028aF-dF. 4v. Available from: NTIS, Springfield, VA; PB87-142378.

technical directives by the EPA WAM, before conducting multi-media modeling and evaluation for other crops. After completing Tasks 2 and 3 for the one crop, the Contractor shall provide recommendations for potential improvements that could be made in the modeling approach before beginning the modeling of additional crops. Subsequently, upon consultation between the Contractor and WAM, the WAM will provide written technical direction on whether to proceed with multi-media modeling of additional crops and, if so, the priority order for the remaining crops to be evaluated.

Task 1. Prepare a Quality Assurance Project Plan (QAPP

The Contractor shall provide a QAPP to the EPA WAM to address the work described under Tasks 2-4. The EPA WAM will review and return the QAPP with comments. The contractor shall revise the QAPP to address all comments and shall submit a revised documentation to the EPA WAM for approval. The contractor shall not commence work involving environmental generation data or use until the EPA WAM has approved the QAPP.

Task 2. Multi-media modeling

A. Ambient air concentrations, deposition rates and concentrations of lead in soil and water available for uptake including historical deposition from aircraft

The Contractor shall estimate ambient air concentrations of lead emitted over crop land using AERMOD, TRIM.FaTE or similar appropriate modeling platform agreed upon in consultation with the EPA WAM. This work may build on previous work ICF completed for EPA in Work Assignment number 4-01 under EPA contract EP-C-06-094 in which ambient air concentrations of lead were estimated at an airport using AERMOD.

The Contractor shall estimate deposition of lead to agricultural plants and their substrates (e.g., water for rice, soil for other crops). These estimates shall be generated using a relevant modeling framework (e.g., AGDRIFT, AGDISP, TRIM.FaTE) agreed upon with the EPA WAM. Consideration of the modeling framework for estimating deposition shall include all parameters specific to this source, including the need to model the solubility of lead dibromide, potential for bioaccumulation of alkyl lead and accounting for the low emission height and turbulence of aircraft exhaust above the substrate surface.

Decisions regarding the modeling framework for this task shall be made in consultation with the EPA WAM and technical representatives. Final approval on the modeling framework shall be made through written technical direction by the EPA WAM.

B. Deposition to plant parts, uptake by plant roots, distribution in plant tissue, and estimates of resulting concentrations in finished crop

The Contractor shall develop inputs for this subtask in coordination with EPA. The estimates of available lead in soil shall include the cumulative contributions of 1) typical current background lead concentrations obtained from the second draft ISA for Pb, 2) current-year lead from piston aircraft used over the specific soil/water substrate, and 3) cumulative aircraft

emissions and deposition from historical aerial application for approximately 50 years prior to the year being modeled. Regarding modeling of the cumulative lead deposition to soil, the COTR and Contractor shall discuss and agree upon a suitable method for incorporating top soil loss each year to incorporate this into the model evaluation.

The Contractor shall take advantage of studies summarized in EPA's draft Integrated Science Assessment (ISA) for relevant literature describing uptake rates of various chemical forms of lead into relevant plant materials for the case study or studies.[9] For example, Table 4-5 on page 4-25 of the second draft ISA lists lead bioaccumulation data for rice and other plants expressed as the percent of lead concentration in the plant to the lead concentration in the soil, lines 23-33 on page 7-19 describe bioaccumulation factors reported for various crops by recent studies, and pages 7-55 to 7-56 describe studies reporting soil lead concentrations that appear to have a negative impact on the rice paddy system.[10] Additional studies with potentially useful data to evaluate uptake of lead into rice have been identified by EPA.[11] [12] [13] [14] [15] [16] [17] [18] [19] [20] [21] [22]

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[9] EPA Integrated Science Assessment for Lead, Second External Review Draft. Feb 2012. Available at: http://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=235331.

[10] Zeng, LS; Liao, M; Chen, CL; Huang, CY. (2007). Effects of lead contamination on soil enzymatic activities, microbial biomass, and rice physiological indices in soil-lead-rice (Oryza sativa L.) system. Ecotoxicol Environ Saf 67: 67-74. http://dx.doi.org/10.1016/j.ecoenv.2006.05.001.

[11] Title: Lead toxicity, uptake, and translocation in different rice cultivars
Author(s): Liu JU; Li KQ; Xu JK; et al. Source: PLANT SCIENCE Volume: 165 Issue: 4 Pages: 793-802 DOI: 10.1016/S0168-9452(03)00273-5 Published: OCT 2003

[12] Title: Pb and Cd uptake in rice roots Author(s): Kim YY; Yang YY; Lee Y Source: PHYSIOLOGIA PLANTARUM Volume: 116 Issue: 3 Pages: 368-372 DOI: 10.1034/j.1399-3054.2002.1160312.x Published: NOV 2002

[13] Title: Iron plaque formation on roots of different rice cultivars and the relation with lead uptake Author(s): Liu Jianguo; Leng Xuemei; Wang Mingxin; et al. Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY Volume: 74 Issue: 5 Pages: 1304-1309 DOI: 10.1016/j.ecoenv.2011.01.017 Published: JUL 2011

[14] Title: Arsenic, cadmium, and lead pollution and uptake by rice (Oryza sativa L.) grown in greenhouse Author(s): Lei Ming; Tie Baiqing; Williams Paul N.; et al. Source: JOURNAL OF SOILS AND SEDIMENTS Volume: 11 Issue: 1 Pages: 115-123 DOI: 10.1007/s11368-010-0280-9 Published: JAN 2011

[15] Title: The influence of pH and organic matter content in paddy soil on heavy metal availability and their uptake by rice plants Author(s): Zeng Fanrong; Ali Shafaqat; Zhang Haitao; et al. Source: ENVIRONMENTAL POLLUTION Volume: 159 Issue: 1 Pages: 84-91 DOI: 10.1016/j.envpol.2010.09.019 Published: JAN 2011

[16] Title: Predicting As, Cd and Pb uptake by rice and vegetables using field data from China Author(s): Zhang Hongzhen; Luo Yongming; Song Jing; et al. Source: JOURNAL OF ENVIRONMENTAL SCIENCES-CHINA Volume: 23 Issue: 1 Pages: 70-78 DOI: 10.1016/S1001-0742(10)60375-0 Published: 2011

[17] Title: Source attributions of heavy metals in rice plant along highway in Eastern China Author(s): Feng Jinfei; Wang Yinxi; Zhao Jian; et al. Source: JOURNAL OF ENVIRONMENTAL SCIENCES-CHINA Volume: 23 Issue: 7 Pages: 1158-1164 DOI: 10.1016/S1001-0742(10)60529-3 Published: 2011

[18] Title: [Characterizing the plant uptake factor of As, Cd and Pb for rice and wheat cereal]. Author(s): Zhang Hong-zhen; Luo Yong-ming; Zhang Hai-bo; et al. Source: Huan jing ke xue= Huanjing kexue / [bian ji, Zhongguo ke xue yuan huan jing ke xue wei yuan hui "Huan jing ke xue" bian ji wei yuan hui.] Volume: 31 Issue: 2 Pages: 488-95 Published: 2010-Feb

[19] Title: Phytoaccumulation of Lead by Selected Wetland Plant Species Author(s): Adhikari Tapan; Kumar Ajay; Singh M. V.; et al. Source: COMMUNICATIONS IN SOIL SCIENCE AND PLANT ANALYSIS Volume: 41 Issue: 22 Pages: 2623-2632 Article Number: PII 930168323 DOI: 10.1080/00103624.2010.517879 Published: 2010

[20] Title: Fractionation of lead in paddy soils and its bioavailability to rice plants Author(s): Li J. X.; Yang X. E.; He Z. L.; et al. Source: GEODERMA Volume: 141 Issue: 3-4 Pages: 174-180 DOI: 0.1016/j.geoderma.2007.05.006 Published: OCT 15 2007

The EPA WAM will provide additional literature to use for input values in evaluating lead deposition, uptake, and translocation in the plant to model ranges of potential lead concentrations in crops for this work assignment. Methods used will be developed in consultation with the EPA WAM and technical representative. Final approval of method used shall be done through written technical direction from the EPA WAM.

C. Generate ranges of lead concentration in crops

The Contractor shall run the model platform agreed upon with the EPA WAM and provide the data in tables reporting ranges of total lead concentration in mg/kg by crop with the contribution of piston aircraft emissions quantified by mg/kg and percent of total lead. The contribution of piston aircraft emissions to the crop lead content shall be for one year of piston aircraft use in cultivation and, separately, the lead content from the historical use of piston aircraft. In addition, to enable Task 4, the Contractor shall extrapolate the resulting ranges of lead concentrations in crops to relevant cultivars among the crop types (i.e., extrapolate the modeled lead concentrations in spinach to other leafy vegetables).

The Contractor shall draw on their previous applications of multi-media modeling and on the literature to draw analogies to lead, as appropriate. For example, multi-media modeling of pesticide deposition and plant uptake from aerial spraying has been conducted and is in the peer reviewed literature. If appropriate pesticide surrogates are identified that are relevant to lead, relevant analogies shall be made quantitatively to benchmark estimates of lead in crops made in this work assignment. EPA WAM will provide examples of potentially relevant pesticides and relevant literature for this work.

Task 3. Evaluate the modeled estimates of lead concentrations in crops

The Contractor shall provide a perspective on the modeled estimates of lead concentrations in crop products by comparing the range of estimated lead concentrations in the final crop products with measurements of lead in these crops. For example, the FDA's 2008 Total Diet Study reports that carrot used in baby food had the second highest Pb concentration in their survey (0.04 – 0.08 mg/kg).[23] The report also includes lead concentrations measured in rice, beans, cabbage, and peas. EPA WAM will provide additional data from USDA and FDA on the lead concentration measured in a variety of leafy vegetables, root vegetables and grains.

The Contractor shall summarize information regarding lead concentrations in the crops evaluated in this multi-media modeling effort to discuss the fraction of this lead that could be attributable to piston aircraft emissions used in cultivating the crop.

Task 4. Estimate lead uptake in people from dietary intake of crops

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[21] Title: Uptake of toxic heavy metals by rice (Oryza sativa L.) cultivated in the agricultural soil near zhengzhou city, people's republic of china Author(s): Liu W.-X.; Shen L.-F.; Liu J.-W.; et al. Source: BULLETIN OF ENVIRONMENTAL CONTAMINATION AND TOXICOLOGY Volume: 79 Issue: 2 Pages: 209-213 DOI: 10.1007/s00128-007-9164-0 Published: AUG 2007

[23] Food and Drug Administration (2008) Total Diet Study.

The Contractor shall estimate the range of lead in a typical daily diet for adults and children consuming crops cultivated using piston aircraft. To provide these estimates, the Contractor shall extrapolate from each of the crop types evaluated to provide these estimates by assuming that root vegetables will have lead concentration ranges similar to those modeled for one root vegetable (e.g., carrots), and that leafy vegetables and grains will likewise have lead concentrations similar to those modeled for a specific leafy vegetable (e.g., spinach) and grain (e.g., rice). The range of estimated lead intake rates from crops for which piston aircraft are used in cultivation shall be compared with recommended dietary limits on lead intake. The Contractor shall discuss the utility of using TRIM.Expo-ingestion for this task or some other method. Decisions regarding the modeling approach to be used shall be made in consultation with the EPA WAM and technical representative. Final approval of the modeling approach used shall be made via written technical direction from the EPA WAM.

DELIVERABLES

1. Conference calls

The Contractor shall provide status updates for the EPA WAM on work accomplished monthly and shall initiate additional contact with the EPA WAM as needed to resolve questions and discuss technical issues encountered. The EPA WAM or designated alternate shall participate in these phone conferences.

2. Data files

The Contractor shall provide EPA WAM with data files containing all data, all model input files including underlying derivations, all model output files and summary files. The Contractor shall provide model output data to EPA WAM for agreed upon time periods, scenarios and receptors. The Contractor shall provide EPA WAM any additional files that would be necessary to recreate the Contractor's analyses.

3. Draft and Final Report

The Contractor shall provide a draft report to EPA WAM for comments. The Contractor shall provide a final report, incorporating EPA comments, within 14 days of receiving comments from EPA. The report shall be in hard copy plus an agreed-upon electronic format. Microsoft Word is the preferred format.

The schedule for task deliverables is as follows:

Task 1 Deliverable: QAPP	July 17, 2012
Task 2 Deliverable: Multi-media modeling	July 20, 2012
Task 3 Deliverable: Evaluate modeled estimates	July 27, 2012
Task 4 Deliverable: Estimate lead in diet	August 13, 2012
Final Report Complete:	September 30, 2012

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-10

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2012	Recording Aircraft Operations
	Base X Option Period Number	

Contractor	Specify Section and paragraph of Contract SOW
ICF INCORPORATED, L.L.C.	Tasks 6b and 6f

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 07/03/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 02/01/2012 To 09/30/2012 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Meredith Pedde (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4748 FAX Number:
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name: Jose Ortiz (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2831 FAX Number: 513-487-2109
Contracting Official Name: Sandra Savage (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2046 FAX Number:

STATEMENT OF WORK

WORK ASSIGNMENT	EPA Contract [EP-C-12-011]
A. Issuing Office:	Environmental Protection Agency
B. Contractor:	ICF International 9300 Lee Highway Fairfax, VA 22031-1207
C. Statement of Work:	Recording Aircraft Operations at General Aviation Airports with Lead Monitors

D. Work Assignment Managers (WAM):

Meredith Pedde
Tel: 734-214-4748
Fax: 734-214-4939
Email: pedde.meredith@epa.gov

Alternate WAM:

Rich Cook
Tel: 734-214-4827
Email: cook.rich@epa.gov

E. Period of Performance: July 3, 2012 – September 30, 2012

Background

Tetraethyl lead is added to aviation gasoline (avgas) which is used in most piston-engine powered aircraft. Lead (Pb) emissions from the use of leaded aviation gasoline accounts for approximately half the air emission inventory for lead. In October 2006, EPA received a petition from Friends of the Earth (FOE) requesting that the Agency find that aircraft lead emissions may reasonably be anticipated to endanger the public health or welfare, and to take action to control lead emissions from piston-engine aircraft. FOE also requested that if there was insufficient information, the EPA should commence a study of the issue. This work continues EPA's investigation and study of lead emitted by piston-engine aircraft and the potential impact on public health and welfare.

Objective

The purpose of the tasks described in this work assignment is to:

1) Collect data on the activity of piston engine aircraft at selected airports on days when ambient air lead concentrations are also being collected; and
2) Collect samples of aviation gasoline at the same airports.

Tasks

Task 1. Prepare a Quality Assurance Project Plan (QAPP)

The Contractor shall provide a QAPP to the EPA WAM to address the work described under Tasks 2-4. The EPA WAM will review and return the QAPP with comments. The contractor shall revise the QAPP to address all comments and shall submit a revised QAPP to the EPA WAM for approval. The contractor shall not commence work involving environmental generation data or use until the EPA WAM has approved the QAPP.

Task 2. Count aircraft activity at airports with lead monitors

For 5 days, the Contractor shall count the number of aircraft landing and taking off from the airports identified in Table 1. For each operation (landing and take-off), the Contractor shall record the runway end used by each aircraft (for landing or take-off) by recording the runway heading, and where necessary if an airport has parallel runways, the additional runway identifier (e.g., 31R). For each aircraft landing or departing from the runway end at which the lead monitor is located, the Contractor shall record the aircraft tail number, an observation of the aircraft type (e.g., jet, turboprop, fixed wing piston aircraft or a helicopter and whether the helicopter was powered by jet engines or piston engines) and any observations that might help EPA to understand the activity of aircraft at each airport as well as any unusual events during the days observed (e.g., several airplanes lined up waiting for take-off, take-off by an unusually large piston aircraft such as a "warbird," or an event at the airport such as an air show that would increase the number of operations above normal). Observations shall be recorded chronologically during the day during the hours the airport is open with a time stamp for each hour of observations. The Contractor shall instruct the individuals counting aircraft to be stationed near the end of the runway where the lead monitor is located. The Contractor shall instruct the individuals counting aircraft not to go near the lead monitor itself and to follow all guidelines communicated by airport personnel to insure safety of the individual recording activity as well as pilots and other personnel.

Table 1. Airports where the Contractor shall count aircraft activity and collect avgas samples (described in Task 2 and Task 4).

Tier 1 Airports	Tier 2 Airports	Tier 3 Airports
Merrill Field, Anchorage, AK	Oakland County International Pontiac, MI	Pryor Field Regional Airport, Limestone County, AL
Brookhaven Municipal Airport, Brookhaven, NY	Deer Valley Airport, Phoenix, AZ	Stinson Municipal Airport, San Antonio, TX
Gillespie Field, San Diego, CA	Harvey Field, Snohomish County, WA	Republic Airport, East Farmingdale, NY
McClellan-Palomar Field, San Diego, CA	Auburn Municipal Airport, WA	Centennial Airport, Denver, CO
San Carlos Airport, San Carlos, CA	Nantucket Memorial Airport, Nantucket Island, MA	Van Nuys Airport, Los Angeles, CA
Palo Alto Airport, Palo Alto, CA		

Currently, state and local air quality monitoring agencies are monitoring at the 16 airports in Table 1 every sixth day. Table 2 identifies the dates when lead monitoring is occurring at these airports during the period of performance of this work assignment.

The Contractor shall provide separate cost estimates for the following 2 scenarios for collecting the 5 days worth of airport operation observations:

1) The Contractor shall collect the 5 days of airport operation observations on five of the dates listed in Table 2, at each of the airports listed in Table 1, of this work assignment.

2) The Contractor shall collect the 5 days of airport operation observations, for each of the airports listed in Table 1, on five consecutive days (as opposed to the 5 days listed in Table 2). The Contractor shall ensure that at least one of the 5 consecutive days includes one of the lead monitoring dates listed in Table 2.

The Contractor shall provide the cost estimates separately for each airport (shown in Table 1).

Table 2. Lead Air Monitoring Sampling Days July – September 2012 at Airports.

July & August	**September & October**
July 5, 2012 Thursday	September 3, 2012 Monday
July 11,2012 Wednesday	September 9, 2012 Sunday
July 17, 2012 Tuesday	September 15, 2012 Saturday
July 23, 2012 Monday	September 21, 2012 Friday
July 29, 2012 Sunday	September 27, 2012 Thursday
August 4, 2012 Saturday	
August 10, 2012 Friday	
August 16, 2012 Thursday	
August 22, 2012 Wednesday	
August 28, 2012 Tuesday	

The Contractor shall conduct airport counts for the Tier 1 airports identified in Table 1 first, starting with Merrill Field, since the lead monitoring at this site may be terminated as early as October 2012. Similarly, lead monitoring at Brookhaven airport may terminate at the end of September 2012 so obtaining aircraft counts at this airport is also a top priority.

Upon written technical direction from the EPA WAM, the Contractor shall proceed with Tier 2 airport counts. After Tier 1 and 2 airport counts are completed, and upon written technical direction from the EPA WAM, the Contractor shall conduct airport counts at the Tier 3 airports listed in Table 1.

The Contractor shall update the EPA WAM weekly on the status of securing personnel to obtain the airport counts. The EPA WAM may provide a list of contacts for airport managers and state and local air monitoring agencies to assist the contractor. If it appears to be too challenging or logistically impossible to obtain aircraft counts from any of the airports in Table 1, the EPA WAM, via written technical direction, may remove the particular airport from the list and select a different airport.

During weekly updates, the Contractor shall inform EPA WAM which airports will have aircraft counts conducted and when, so that EPA can confirm with the state or local air monitoring agency that the monitor is running and collecting valid air samples.

The Contractor shall accomplish airport counts as soon as practical since the summer flying season is underway and at many airports flights by piston aircraft will decrease in the fall season. If possible, the Contractor shall conduct observations at multiple airports simultaneously.

Task 3. Collecting meteorological data

The Contractor shall collect meteorological data on the days when aircraft are being counted. The data shall be provided to EPA WAM as hourly wind speed and wind direction. The data may be collected with a handheld device or similar technology.

Task 4. Collecting avgas samples

The Contractor shall collect at least one sample of avgas from each fuel supplier (fixed based operator) at each airport where aircraft are counted. EPA WAM will provide the following: specifications for sample collection bottles and related supplies (will be issued by the EPA WAM as a technical direction), crimpers needed to seal sample containers (to be returned to EPA at the completion of the work assignment), sample collection protocol, and shipping drums (to be returned to EPA at the completion of the work assignment). The Contractor shall ship avgas samples to EPA for analysis. Note that avgas samples cannot be collected from Merrill Field because shipping regulations will not allow transport of a sample from this location.

Reporting Deliverables

Conference calls: The Contractor shall provide status updates for the EPA WAM on securing personnel for airport activity counts weekly and shall initiate additional contact with the EPA WAM as needed to resolve questions and discuss technical issues encountered. The EPA WAM or designated alternate shall participate in these phone conferences.

Data files: The Contractor shall provide EPA WAM with Excel data files containing all aircraft observation data collected in Tasks 2 and 3, and any relevant notes taken by the person observing aircraft. These notes shall be sufficient to allow EPA to identify the airport, the day of observation, time of day, aircraft tail number, aircraft type if easily identified (e.g., airframe manufacturer and model), engine type if easily and positively recognized (e.g., piston or jet) and any observer's notes as described in Task 2. The Contractor shall also provide any notes and observations from the person collecting and shipping avgas samples. The Contractor shall summarize the meteorological data in Excel by airport, day, and hour and provide a graphical representation of wind direction on each day aircraft were counted, using a wind rose to display the percent of the time the wind was from each direction.

The schedule for task deliverables is as follows:

Task 1 Deliverable: QAPP	July 25, 2012
Task 2 Deliverable: Aircraft activity at airports with lead monitors	September 30, 2012
Task 3 Deliverable: Meteorological data	September 30, 2012
Task 4 Deliverable: Avgas samples	upon collection from each airport

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-11

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2012	Particle Number Emissions Meas
	Base X Option Period Number	

Contractor	Specify Section and paragraph of Contract SOW
ICF INCORPORATED, L.L.C.	Task 6, Task 10, Task 11

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 07/25/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period:	Cost/Fee:	LOE:
02/01/2012 To 09/30/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Bob Giannelli (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4708 FAX Number:
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name: (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Sandra Savage (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2046 FAX Number:

PERFORMANCE WORK STATEMENT

A. EPA Contract:	EP-C-12-011
B. Work Assignment (WA):	0-11
C. Issuing Office:	EPA Office of Transportation and Air Quality (OTAQ) 2000 Traverwood Dr. Ann Arbor, Michigan 48105
D. Contractor:	ICF International 9300 Lee Highway Fairfax, VA 22031-1207
E. Statement of Work:	Particle Emissions Measurement Training and Analysis
F. Work Assignment Manager (WAM)	Dr. Bob Giannelli 734-214-4708 giannelli.bob@epa.gov
Alternate WAM	Bryan Manning 734-214-4832 manning.bryan@epa.gov

I. BACKGROUND

Measurement of particulate matter (PM) emissions from combustion engines is motivated by the detrimental health effects PM has on human health. PM from combustion sources is chemically complex and has transport properties different than gaseous emissions and hence needs careful consideration; the metric by which it is measured and the method of measurement is under extensive discussion. Additionally, improvements in engine operation and exhaust after treatment devices have been decreasing PM emissions to levels that are pushing the lower limits of current mass measurement devices.

In order to address measurement limits, a well-intentioned program in Europe has been initiated using nonvolatile particulate matter number as the regulatory metric. The California Air Resources Board (CARB), California's air quality regulatory agency, is also considering a number metric for regulatory purposes. However, this number metric is not expected to replace the total PM mass-based National Ambient Air Quality Standard (NAAQS) because, if it is used alone, it will not fully address the short comings of a PM mass measurement. However, the U.S. EPA believes there is a necessity at this point to address the PM number metric with a reference method that attempts to address the motivations behind regulatory actions, i.e., detrimental health effects.

PM is distinguished from gases by its relative size to gases and its resultant transport and chemical processes. When designing a sampling system, a main concern of measuring PM is the inherent losses that can take place in the sample train during transport from the emissions source to the measurement instrument. These losses can lead to an underestimation of the amount of true PM emissions from a combustion source. In measuring PM from an aircraft engine, the sample train has been determined to have sample line lengths and thermal differences between the sample gas and the sample train elements that are unavoidable. Estimates of the nonvolatile particulate matter mass loss in the sample train are on the order of 40-50%. This large loss leads to a reasonable concern over the accuracy of the measurement method.

In order to address the two items above, (i.e., design a measurement reference method for particle number and review of a method to estimate sampling train particle losses), the EPA has determined that it has the following needs:

1) A need for training to fully understand the nature of PM emissions, measurement, characterization, and source development. Specialized training in the physical and chemical properties of aerosol particles and their interaction with the atmosphere is also required. As a result of this training, EPA will be better positioned to develop a PM number measurement reference method.

2) A need for a PM emission measurement expert who can review a PM emissions measurement sample train and the methods for estimating losses in PM sample trains and deliver a report on the findings of the review.

II. TASKS

The purposes of this work assignment (WA) are to obtain training required to allow EPA to develop a particulate matter number measurement reference method and to have a PM number expert perform a review of a PM measurement method.

Task 1

The Contractor shall arrange for training to be provided by technical experts in the subject areas described in subtasks below. Training shall be provided to EPA at its Ann Arbor office prior to September 30, 2012. The address where the training shall be provided is:

2000 Traverwood Dr.
Ann Arbor, Michigan 48105

For Subtask 1A, 3-5 trainers shall be provided and for Subtask 1B, 4-7 trainers shall be provided; however, the total number of trainers under this task shall not exceed 10. Each trainer shall provide 2-8 hours of training, as applicable depending on the trainer's proposed agenda. Only one trainer shall be scheduled for any given day. EPA will provide a list of subject area technical experts who the Contractor may wish to consider for the purposes of this WA. The Contractor shall discuss with the EPA WAM the proposed list of trainers and associated training

dates prior to engaging said trainers. The EPA WAM will provide final approval of the trainer and associated training dates via written technical direction.

Subtask 1A: PM Emissions, measurement, characterization, source development

EPA requires the knowledge of experts in sampling and characterization of aerosol particles ranging from particles as small as 1 nm diameter up to particles exceeding 100 μm in size. At minimum, an expert shall be able to address the following topics:

a. characterization of devices for removing particulate matter from combustion products;
b. dynamics of diesel exhaust and other carbonaceous aerosols;
c. electronic engine control, engine sensors, and on-board diagnostics;
d. continuous measurement of airborne particulate sulfur, carbon, and nitrogen;
e. measurement of ultrafine particles in gases and liquids including analysis of PM loss in the PM measurement sample trains;
f. the physical and chemical characterization of exhaust emissions;
g. the evaluation of emission controls;
h. the evaluation and demonstration of alternative fuels, certification of on- and off-highway engines, and the evaluation of control technology in the field;
i. engine test cells for engines from 10 to 600 hp, and computer-controlled dynamometers capable of simulating many transient and steady-state duty cycles;
j. assisting industry and government in developing and evaluating technologies to meet present and future emission standards;
k. dilution system design and development of PM emissions sources such as EPA's PM generator.

Suggested experts for Subtask 1A:
1) Rick Flagan (California Institute of Technology, phone: 626-395-4383, email: flagan@cheme.caltech.edu)
2) Imad Khalek (SwRI, phone: 210-522-2536, email: imad.khalek@swri.org)
3) David Kittleson (University of Minnesota, phone: 612-625-1808, email: kitte001@umn.edu)
4) Mike Kleeman (University of California, Davis, phone: 530-752-8386, email: mjkleeman@ucdavis.edu)
5) Peter McMurray (University of Minnesota, phone: 612-624-2817, email: mcmurry@me.umn.edu)
6) David Pui, (University of Minnesota, phone: 612 625-2537, email: dyhpui@umn.edu)

Subtask 1B: Subject Area: Properties of aerosol particles, including atmospheric interaction

EPA requires the knowledge of established experts on laboratory characterization and modeling of atmospheric chemistry and formation of secondary organic aerosols and the gaseous precursors responsible for their formation. At minimum, an expert shall be able to address the following topics:

a. laboratory studies of the growth, crystallization, nucleation, and freezing of aerosol

particles under atmospherically relevant conditions;

b. modeling of atmospheric chemistry and formation of secondary organic aerosols and the gaseous precursors responsible for their formation;
c. laboratory phase transitions studies of aerosol particles methods such as optical microscopy;
d. laboratory studies of chemical composition and morphological features through the use of methods such as computer-controlled scanning electron microscopy with energy dispersive analysis of X-rays (CCSEM/EDX) and scanning transmission X-ray microscopy with near edge X-ray absorption fine structure spectroscopy (STXM/NEXAFS);
e. laboratory studies of chemical composition and morphological using electron and X-ray beams for imaging, spectroscopy and diffraction and ultrafast X-ray holography;
f. multiscale computational nanoscience to study the formation and fate of nanoparticles in the environment

Suggested experts for Subtask 1B:

1) Daniel Knopf (State University of New York, Stoney Brook, phone: 631-632-3092, email: Daniel.Knopf@stonybrook.edu)
2) Robert McGraw (Brookhaven National Laboratory, email: rlm@bnl.gov, website : http://www.ecd.bnl.gov/asdrosters.html#mcgraw)
3) Joyce Penner (Ralph J. Cicerone Distinguished University Professor of Atmospheric Science, University of Michigan, phone: (734) 936-0519, email: penner@umich.edu)
4) Allen Robinson (Carnegie-Mellon University, Pittsburgh, PA, phone: 412-268-3657, email: alr@andrew.cmu.edu)
5) John Spence (Arizona State University, phone: 480-965-6486, email: john.spence@asu.edu)
6) John Venables (Arizona State University, phone: 480-965-1675, email: venables@asu.edu)
7) Angela Violi (Associate Professor of Mechanical Engineering, Biomedical Engineering, and Chemical Engineering, phone: (734) 615-6448, email: avioli@umich.edu)
8) Alla Zelenyuk-Imre, (Pacific Northwest National Laboratory, Richland, WA, phone: 509-371-6155, website: http://www.pnl.gov/science/staff/staff_info.asp?staff_num=5531)

Task 2 – Evaluation of the methodologies for measuring the properties and characterization of aerosol transport systems and losses

The EPA requires the knowledge of established experts on physical and numerical modeling of aircraft engine emissions characterization and contrail formation, including analysis of PM loss in the PM measurement sample trains. The contractor shall provide 2-3 experts to review the methods being developed by the SAE E-31 Aircraft Exhaust Emissions Measurement Committee to account or correct for PM loss in the sample trains (for PM aircraft engine test procedure being developed by E-31). The experts shall review the E-31 methods, including any papers, reports, and documentation generated by E-31 for this PM loss correction method, and each provide a technical report or memorandum on their assessment of this method.

The contractor may consider experts found in the suggested expert lists from Subtasks 1A and 1B to complete this task.

III. DELIVERABLES

1. Kick off Meeting. Within one week after the WA is issued, but prior to the Contractor submitting a Work Plan, the Contractor shall discuss this work assignment with the EPA WAM to ensure a common understanding of the requirements, expectations, and ultimate end products.

2. Schedule Training. Within one week of receipt of written technical direction from the EPA WAM, the Contractor shall schedule each training session. Each trainer shall provide a training session agenda to the EPA WAM one week prior to arrival. Trainers shall provide an electronic copy of presentation materials to the EPA WAM.

3. Weekly Progress Reports. The contractor shall provide the EPA WAM with brief weekly status reports via telephone conference or email during the period of performance. The progress report shall indicate the progress achieved in the concluded weeks, technical problems encountered, solutions to those problems, and projected activity for the upcoming weeks. Before proceeding with any solution to a problem, the contractor shall report the problem and consult with the EPA WAM concerning the scope of the solution.

Schedule of Deliverables

Steps	**Completion Date**
Complete Tasks 1 and 2	Before September 30, 2012

NON-DISCLOSURE AGREEMENT
All documentation acquired and/or provided by EPA or generated as a result of this project shall be under the control of the U.S. EPA Assistant Administrator for Air and Radiation, or his or her designated representative, and shall not be released by the Contractor to any other source without specific approval by the U.S. EPA.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-11

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2013	Particle Emissions Measurement
	Base X Option Period Number	

Contractor	Specify Section and paragraph of Contract SOW
ICF INCORPORATED, L.L.C.	Task 6, 10, 11

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 07/25/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
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Authorized Work Assignment Ceiling

Contract Period:	Cost/Fee:	LOE:
02/01/2012 To 09/30/2013		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Bob Giannelli (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4708 FAX Number:
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name: (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Sandra Savage (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2046 FAX Number:

PERFORMANCE WORK STATEMENT

A. EPA Contract:	EP-C-12-011
B. Work Assignment (WA):	0-11, Amendment 1
C. Issuing Office:	EPA Office of Transportation and Air Quality (OTAQ) 2000 Traverwood Dr. Ann Arbor, Michigan 48105
D. Contractor:	ICF International 9300 Lee Highway Fairfax, VA 22031-1207
E. Statement of Work:	Particle Emissions Measurement Training and Analysis
F. Work Assignment Manager (WAM)	Dr. Bob Giannelli 734-214-4708 giannelli.bob@epa.gov
Alternate WAM	Bryan Manning 734-214-4832 manning.bryan@epa.gov

The purpose of this work assignment amendment is to provide travel authorization for the measurement method reviewers.

Task 2 is amended to read as follows (new language in **bold**)**:**

Task 2 – Evaluation of of the methodologies for measuring the properties and characterization of aerosol transport systems and losses

The EPA requires the knowledge of established experts on physical and numerical modeling of aircraft engine emissions characterization and contrail formation, including analysis of PM loss in the PM measurement sample trains. The contractor shall provide 2-3 experts to review the methods being developed by the SAE E-31 Aircraft Exhaust Emissions Measurement Committee to account or correct for PM loss in the sample trains (for PM aircraft engine test procedure being developed by E-31). The experts shall review the E-31 methods, including any papers, reports, and documentation generated by E-31 for this PM loss correction method, and each provide a technical report or memorandum on their assessment of this method.

The contractor may consider experts found in the suggested expert lists from Subtasks 1A and 1B to complete this task.

Each expert shall have at least one but no more than two trips to the EPA Office Building in Ann Arbor, MI for in-person discussion. One of those trips shall be near the end of the review to discuss the reviewers' findings. The other should be at the beginning of the review. Logistics and timing shall be discussed with the EPA WAM prior to scheduling the trips.

I. DELIVERABLES

1. Kick off Meeting. Within one week after the WA is issued, but prior to the Contractor submitting a Work Plan, the Contractor shall discuss this amendment with the EPA WAM to ensure a common understanding of the requirements, expectations, and ultimate end products.

2. Schedule Travel. Within one week of receipt of written technical direction from the EPA WAM, the Contractor shall schedule each travel session.

Schedule of Deliverables

Steps	Completion Date
Schedule travel	Before September 30, 2012

NON-DISCLOSURE AGREEMENT
All documentation acquired and/or provided by EPA or generated as a result of this project shall be under the control of the U.S. EPA Assistant Administrator for Air and Radiation, or his or her designated representative, and shall not be released by the Contractor to any other source without specific approval by the U.S. EPA.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-12

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2012	Refinery Modeling Training
	Base X Option Period Number	

Contractor: ICF INCORPORATED, L.L.C.

Specify Section and paragraph of Contract SOW: Task 1 Fuels, Task 10 Training

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 08/01/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
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Authorized Work Assignment Ceiling

Contract Period: 02/01/2012 To 09/30/2012 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Lester Wyborny (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4473 FAX Number:
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name: (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Sandra Savage (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2046 FAX Number:

PERFORMANCE WORK STATEMENT

A.	EPA Contract:	EP-C-12-011
B.	Work Assignment (WA):	0-12
C.	Issuing Office:	EPA Office of Transportation and Air Quality (OTAQ) 2000 Traverwood Dr. Ann Arbor, Michigan 48105
D.	Contractor:	ICF International 9300 Lee Highway Fairfax, VA 22031-1207
E.	Statement of Work:	Refinery Modeling Training
F.	Work Assignment Manager (WAM):	Lester Wyborny, wyborny.lester@epa.gov, (734) 214-4493
	Alternate WAM:	Russ Smith, smith.russ@epa.gov, (202) 343-9996

I. Background

To conduct cost analyses, EPA staff use Haverly's GRTMPS (Generalized, Refining Transportation Marketing Planning System) linear programming refinery model. Currently, EPA staff is running the GRTMPS refinery model on an aggregated 5 region refinery cost model case, as well as individual PADD models. The 5 region case was developed solely by Jacobs Consultancy.

Because the GRTMPS models are complex refinery models, EPA staff requires additional training support to operate the models correctly. This training support includes review and analysis of modeling outputs generated by EPA to ensure realistic results.

II. Task

The contractor shall provide training to EPA regarding any or all aspects of the GRTMPS (Haverly) model and its components on the 5-region model and the individual PADD models. The contractor shall also provide training in developing, running and interpreting a separate spreadsheet program for conducting a mass and energy balance.

This training could include set-up assistance and troubleshooting, incorporating model components in running the model, changing input values and output forms, and guiding EPA in evaluating results obtained by EPA's modeling effort for completeness, accuracy, viability, etc.

The training could also include suggested changes to model tolerances to ensure convergence.

The EPA WAM will specify the refinery modeling issues to be covered and the order in which they are covered via written technical direction; however, the Contractor may also suggest topics. Training shall be provided in person at the Contractor's site, via teleconference, or via videoconference. The Contractor shall provide for a total training time of one business week (5 days). These could be full days, part-days, or even as short as hour-long sessions. Any electronic or hardcopy materials created for the purposes of training under this work assignment become the property of the EPA (and shall be provided to the EPA WAM).

III. Deliverables

1) Schedule and complete training.

Schedule of Deliverables

Steps	**Completion Date**
Complete Task	Before September 30, 2012

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-13

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2012	Development of ¿Super DELTA¿ M
	Base X Option Period Number	

Contractor: ICF INCORPORATED, L.L.C.

Specify Section and paragraph of Contract SOW: Task 7a and 8c

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 08/13/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
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Authorized Work Assignment Ceiling

Contract Period: 02/01/2012 To 09/30/2012 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Connie Hart (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4340 FAX Number:
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Sandra Savage (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2046 FAX Number:

PERFORMANCE WORK STATEMENT

A. EPA Contract:	EP-C-12-011
B. Work Assignment (WA):	0-13
C. Issuing Office:	EPA Office of Transportation and Air Quality (OTAQ) 2000 Traverwood Dr. Ann Arbor, Michigan 48105
D. Contractor:	ICF International 9300 Lee Highway Fairfax, VA 22031-1207
E. Statement of Work:	Development of "Super DELTA" Model Proposal for Evaporative Emissions
F. Work Assignment Managers (WAM)	Connie Hart 734-214-4340 hart.connie@epa.gov
G. Alternate WAM	David Brzezinski 734-214-4235 brzezinski.david@epa.gov

I. BACKGROUND

The U.S. Environmental Protection Agency (EPA) has been developing new tools for the modeling of evaporative emissions. The DELTA model (Diurnal Emissions Lost To Atmosphere) was an initial attempt to more accurately model the tank vapor generated emissions using the Wade-Reddy equation as applied to a fleet of vehicles. By modeling a single vehicle's response over the course of multiple diurnals, the DELTA model can generate a relationship between tank vapor generated (TVG) and tank vapor vented to the atmosphere (TVV) as a TVG – TVV curve. Multiple single vehicle models were then combined to create a single, weighted TVG – TVV curve representative of the entire fleet for use in the MOVES model, including specific vehicle standard groups such as Pre-enhanced, Enhanced/Tier 1 and Tier 2. The MOVES 2010a model contains evaporative emissions estimates based on older data that could not adequately model emissions beyond one day of diurnals. The DELTA model was created to update MOVES 2010a evaporative vapor emissions to extend beyond one day of diurnals as well as taking advantage of newer datasets. The results from the DELTA model were then compared to and calibrated with recent multiple day diurnal emissions test data.

This model was recently peer reviewed before updating the MOVES model and for regulatory use (See Attachments A and B). Some of the comments cautioned the oversimplification of the single vehicle approach and did not incorporate all of the potential conditions when averaged over the fleet. There could be potential serious under estimations by not considering the distributions of all in-use conditions.

II. OBJECTIVE

The objective of this work assignment is to provide consultation in the development of a "Super DELTA" version which addresses the peer review concerns and update the approach for modeling the other evaporative emission processes such as Hot Soak, Running Loss, Permeation, and Liquid Leaks.

III. SCOPE OF WORK

Task 1: Consultation with the EPA MOVES Evaporative Modeling Team

The contractor shall provide a national evaporative emissions expert as a consultant to travel to the National Vehicle and Fuels Emissions Laboratory (NVFEL) in Ann Arbor to meet with the MOVES Evaporative Modeling Team over a two day period. The expert shall have knowledge of vehicle evaporative control systems and emissions mechanisms, particularly emissions from the carbon canister and vehicle leaks. The expert shall also possess some familiarity with how evaporative emissions are modeled in the EPA MOVES model. The list of experts to be contacted shall require approval from the EPA WAM. During this two day period, the Evaporative Modeling Team will explain the initial thinking and proceed to brainstorm with the consultant for an improved approach for MOVES evaporative emissions modeling. The goal of the meeting shall be consensus on an approach for further development.

Task 2: Develop Strawman Proposal for "Super DELTA"

The national evaporative emissions expert shall develop a comprehensive proposal based upon the approach outlined in Task 1, for the modeling of evaporative emissions processes in the MOVES model, a "Super DELTA". The proposal shall include the following processes:

A. Cold Soak
B. Hot Soak
C. Running Loss
D. Permeation
E. Liquid and vapor leaks

The consultant shall include issues which they feel will result in weaknesses in the approach due to structure or data gaps. The consultant shall propose alternatives as needed with associated pros and cons, and/or make a proposal for a new test program to fill the data needs.

Task 3: Presentation of Proposal for "Super DELTA"

The consultant shall travel to the NVFEL in Ann Arbor to present the proposal developed in Task 2. The contractor shall allow for a full day of meetings for the presentation and discussion.

IV. DELIVERABLES

1. Status updates

The contractor shall provide the EPA WAM with weekly status reports via telephone conference or email during the period of performance. The progress report shall indicate the progress achieved since the last phone meeting, any issues encountered, solutions to those problems, and projected activity for the upcoming weeks. Before proceeding with any solution to a problem, the contractor shall report the problem and consult with the EPA WAM concerning the scope of the solution.

2. Draft and Final Reports.

The contractor shall provide to the EPA WAM a Draft Final Report. The contractor shall deliver the Final Report within 5 business days from the day that the EPA WAM delivers the reviewed draft report back to the contractor.

Proposed Schedule of Deliverables

Steps	Completion Date
Visit to Ann Arbor	Week of August 20, 2012
Draft Report/presentation in Ann Arbor	Week of September 17, 2012
Final Report	September 30, 2012

NON-DISCLOSURE AGREEMENT
All documentation acquired and/or provided by EPA or generated as a result of this project shall be under the control of the U.S. EPA Assistant Administrator for Air and Radiation, or his or her designated representative, and shall not be released by the Contractor to any other source without specific approval by U.S. EPA.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-14

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2012	Portable Control System for Vo
	Base X Option Period Number	

Contractor	Specify Section and paragraph of Contract SOW
ICF INCORPORATED, L.L.C.	Tasks 2, 3, 7

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 08/23/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
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4										
5										

Authorized Work Assignment Ceiling

Contract Period: 02/01/2012 To 09/30/2012 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name: Brian Nelson (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4278 FAX Number:
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Sandra Savage (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2046 FAX Number:

PERFORMANCE WORK STATEMENT

A. EPA Contract:	EP-C-12-011
B. Work Assignment (WA):	0-14
C. Issuing Office:	EPA Office of Transportation and Air Quality (OTAQ) 2000 Traverwood Dr. Ann Arbor, Michigan 48105
D. Contractor:	ICF International 9300 Lee Highway Fairfax, VA 22031-1207
E. Statement of Work:	Powertrain Tests and Validation – Portable Control System for 2012 Volvo D13 Engine
F. Work Assignment Managers (WAM)	Brian Nelson 734-214-4278 nelson.brian@epa.gov
Alternate WAM	Chris Laroo 734-214-4937 laroo.chris@epa.gov

I. BACKGROUND

The U.S. Environmental Protection Agency (EPA) and the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) recently announced a first-ever program to reduce greenhouse gas (GHG) emissions and improve fuel efficiency of heavy-duty trucks and buses. This program is the first phase of the multi-stage GHG reduction approach. Hybrid system certification is part of the program. Due to technical challenges to quantify hybrid vehicle benefits as opposed to conventional vehicles, the agencies, working together with industrial stakeholders, are developing different concepts for certification. This concept necessarily relies on a conventional engine "baseline" for use of comparison with the new engine technologies. Consequently, this work assignment will focus on measuring the baseline emissions of a current, state-of-the-art engine and control system.

II. OBJECTIVE

The main objective of this work assignment is to develop and construct a portable control system for a current, state-of-the-art engine and control system. An engine which is fully compliant (i.e. no waivers granted) with EPA 2010 emissions and heavy-duty onboard diagnostic (OBD)

standards is required. This engine must also use the predominant method for controlling NOx emissions in the U.S. and European heavy-duty truck markets, which is urea-based selective catalytic reduction (SCR) exhaust aftertreatment. The manufacturer should have several years of on-road, production experience with closed-loop (i.e. feedback control) urea-SCR technology, to assure that the control system, calibrations, and diagnostics are mature in their development. In addition, the displacement of this engine should be nominally 13 liters and capable of producing a nominal 300-to-500 horsepower, depending on the engine calibration. This engine size represents a significant portion of the Class 8 tractor market, and is thus a valuable input to EPA's engine modeling efforts. The one engine we are aware of that is capable of meeting these requirements is the model year 2012 Volvo D13 engine. To make this engine capable of running in a dynamometer test cell – and control emissions as if it were installed in a truck – a 'portable control system' must be designed and built for this purpose.

III. SCOPE OF WORK

Task 1: Development of Portable Control System for a 2012 Volvo D13 Engine

The contractor shall develop and construct a "portable control system" for a 2012 Volvo D13 (13-liter) engine. The portable control system shall allow the engine to operate as if it were installed in a Class 8 tractor, and generally consists of a specially-modified wiring harness, sensors, simulators (if needed), engine control unit (ECU), and ECU calibrations, as well as any peripheral controller(s) and calibrations that may be needed to operate the exhaust aftertreatment devices. The portable control system shall be capable of operating and monitoring the engine and all exhaust aftertreatment components, shall have a functioning On-Board Diagnostic (OBD) monitoring system, and shall be capable of communicating the state of engine operating parameters and fault codes with a diagnostic tool. The portable control system shall be capable of operating the engine in both emissions-compliant as well as engine-mapping modes. This task encompasses the design, development, and manufacture of the necessary components and software. This task requires that the functionality of the portable control system be validated: the control system must be fully functional and pinouts must be verified.

IV. DELIVERABLES

1. Weekly Progress Reports. The contractor shall provide the EPA WAM with weekly status reports via telephone conference or email during the period of performance. The progress report shall indicate the progress achieved in the concluded weeks, technical problems encountered, solutions to those problems, and projected activity for the upcoming weeks. Before proceeding with any solution to a problem, the contractor shall report the problem and consult with the EPA WAM concerning the scope of the solution. The progress report shall also include an estimate of the percentage of each task completed to date, and the resources (level of effort and cost) expended on each task.

2. Technical Report. The contractor shall provide the EPA WAM with a brief Technical Report upon completion of the task. Depending on the complexity of the subject matter and as

provided in written technical direction by the EPA WAM, the report shall be in the form of a presentation or formal written document. Written products shall be delivered in formats specified by the EPA WAM (e.g., Word, Excel).

3. Data. The contractor shall provide to the EPA WAM test and other data that supports the tasks. The data shall be delivered in formats specified by the EPA WAM (e.g., Word, Excel).

Schedule of Deliverables

Steps	**Completion Date**
Kick-off meeting between contractor and EPA WAM	Within 1 week of receipt of work assignment
Develop portable control system	Before September 30, 2012
Technical Report	Before September 30, 2012

NON-DISCLOSURE AGREEMENT

All documentation acquired and/or provided by EPA or generated as a result of this project shall be under the control of the U.S. EPA Assistant Administrator for Air and Radiation, or his or her designated representative, and shall not be released by the Contractor to any other source without specific approval by U.S. EPA.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-15

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2012	Advanced Engine Maps and Vehic
	Base X Option Period Number	

Contractor	Specify Section and paragraph of Contract SOW
ICF INCORPORATED, L.L.C.	Task 2, Task 7

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 08/23/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 02/01/2012 To 09/30/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Jeff Cherry (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4371 FAX Number:
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name: Jose Ortiz (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2831 FAX Number: 513-487-2109
Contracting Official Name: Sandra Savage (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2046 FAX Number:

PERFORMANCE WORK STATEMENT

A. EPA Contract:	EP-C-12-011
B. Work Assignment (WA):	0-15
C. Issuing Office:	US Environmental Protection Agency 2000 Traverwood Drive Ann Arbor, MI 48105
D. Contractor:	ICF International 9300 Lee Highway Fairfax, VA 22031-1207
E. Statement of Work:	Advanced Engine Maps and Vehicle Data
F. Work Assignment Manager (WAM):	Jeff Cherry cherry.jeff@epa.gov, (734) 214-4371
Alternate WAM:	Christine Brunner brunner.christine@epa.gov, (734) 214-4287

I. BACKGROUND

In fulfillment of its EPCA and EISA requirements and in response to President Obama's directive to create a coordinated and harmonized National Program for motor vehicle efficiency and emissions standards, EPA published a joint final rule with the NHTSA to set CAFE standards under EPCA/EISA and greenhouse gas (GHG) standards under the Clean Air Act (CAA) for passenger cars and light trucks manufactured in model years 2012-2016.[1] The CAFE standards will increase annually, and for MY 2016 are estimated to require a combined industry-wide fleet fuel economy of 34.1 mpg. Building on the success of the National Program for the MYs 2012-2016 standards, on May 21, 2010, President Obama directed EPA and NHTSA to work with the State of California and take the next steps to improve fuel economy and reduce GHG emissions from mobile sources for model years 2017-2025.

In order to develop the 2017-2025 standards, the agency has extensively used vehicle simulations to estimate improvements on fuel economy of vehicles resulting from implementations of various advanced fuel-saving technologies. These types of vehicle models and simulation techniques have been widely used in industry as well as in academia for vehicle performance evaluations and fuel economy estimations. Typically, these vehicle models require engine maps

[1] The final rule was issued on April 1, 2010, and was published in the Federal Register on May 7, 2010, at 75 Fed. Reg. 25324. A copy is also available on NHTSA's website at http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/CAFE-GHG_MY_2012-2016_Final_Rule_FR.pdf (last accessed July 12, 2010).

to operate properly. These engine maps consist of fuel consumption maps, and maximum and minimum engine torque curves, which are usually obtained from engine dynamometer tests.

As a part of the 2017-2025 rule, EPA and NHTSA have agreed with the automotive industry that they will conduct the mid-term evaluation in 2021, where the adequacy of the rule's stringency on GHG standards will be re-evaluated. For this mid-term evaluation, the internally developed full vehicle simulation tool, called ALPHA (Advanced Light-Duty Powertrain and Hybrid Analysis), will be used extensively on technical analysis. Before ALPHA can be put into a use for such technical analysis, it must be rigorously evaluated and validated against actual vehicle test data. Engines with advanced features that will result in fuel economy improvement and engine-out emission reduction while delivering required performance must be available for the simulation tool. Currently, most of these advanced engines are at development stages in the automotive industry and therefore not readily available for EPA to evaluate. For this reason, EPA must rely on experimental engines and their test data in order to estimate impact of advanced engine technologies on vehicle fuel economy improvement via vehicle simulations.

II. OBJECTIVE

The objective of this work assignment is to obtain the following information:

(1) Non-hybrid production vehicle test data that will allow EPA to calibrate and validate the ALPHA tool, and

(2) Engine maps of baseline and advanced engine(s).

Task 1

The contractor shall provide approximately six sets of non-hybrid production vehicle data measurements generated from representative vehicles of the current light duty vehicle fleet. The required measurements include:

- Ambient Pressure & Temperature
- Accelerator & Brake Pedal Positions
- Throttle Angle
- Fuel Injection Rate
- Engine Speed & Torque
- Transmission Output Speed
- Transmission Gear
- Vehicle Speed
- Emissions (CO_2, CO, HC, NO_x)

  Note: At minimum, the contractor shall provide the CO_2 measurement. Please provide separate quotes, one with the CO_2 only and another one including all emissions measurements.

Each vehicle shall have been tested on a chassis dynamometer for transient conditions. These test conditions include driving cycles, such as FTP, Highway, and US06. Data from other driving cycles such as LA92 or SC03 may also be included. The data must be at least 10 Hz in sampling frequency.

Along with the test data, the contractor shall provide the following vehicle-related parameters:

- Final Drive Ratio
- Vehicle Frontal Area
- Vehicle Weight
- Tire Radius
- Road Load Coefficients
  - Tire Rolling Resistance & Coefficient of Drag
  - Or, Coast-Down Coefficients

The contractor shall also provide the following engine/transmission data:

- Engine Map
  - Maximum (Wide-Open Throttle) Torque Curve vs. Engine Speed
  - Minimum (Closed Throttle) Torque Curve vs. Engine Speed
  - Fuel Map (in either fuel flow [g/sec] or Brake Specific Fuel Consumption [g/kWh] on engine speed & torque plane
- Torque Converter Tables (if automatic transmission)
  - Torque Ratio vs. Speed Ratio
  - K-Factor (or Capacity Factor) vs. Speed Ratio
  - Efficiency vs. Speed Ratio
- Ratio and Efficiency of Each Gear
- Transmission Upshift and Downshift Schedules

Task 2

The contractor shall provide engine maps for the following engine technologies:

(1) Baseline Engine:
This engine represents a typical Spark-Ignition (SI), Port-Fuel Injection (PFI), Naturally-Aspirated (NA) engine equipped with a Variable Value Actuation (VVA) technology. In this technology, the valve timing (both intake and exhaust) is continuously varied over a wide range of engine operating conditions in order to result in optimal engine breathing efficiency. The engine map shall represent engines with displacement volume of approximately 1.2 liters to 2 liters. Multiple baseline maps may be provided if required to represent this range of displacement.

(2) Single-Turbo Central Direct-Injection (DI) Engine:
This advanced engine builds upon the baseline engine defined previously and assumes turbocharging and continued use of a stoichiometric air-fuel ratio for simplified aftertreatment using a three-way catalyst. The engine shall have a peak Brake Mean Effective Pressure (BMEP) of more than 20 bar to support significant downsizing (e.g. about 50%) compared to current 2010 engines. This high BMEP level is reached through a combination of engine technologies, including DI and advanced boost systems. This engine map shall represent an engine with a displacement volume of approximately 1.2 liters.

(3) Twin-Turbo Central Direct-Injection (DI) Engine:
This engine has the same basic technologies as the Single-Turbo Central Direct-Injection (DI) Engine, except that it has a two-stage turbocharger system at the engine intake. This engine map shall represent an engine with a displacement volume of approximately 1.2 liters.

(4) Miller-Cycle Engine:
A Miller-cycle SI engine is typically designed with a higher geometric compression ratio than the comparable NA engine. The Miller cycle is characterized by leaving the intake valves open during the start of the compression stroke, which lowers the effective compression ratio of the engine back to that of the normal SI engine, but allows for a larger effective expansion ratio. This change in engine operation improves fuel consumption, but penalizes torque availability at lower engine speeds. This Miller-Cycle engine must be based on the Baseline engine described earlier in order to make direct comparisons. This engine map shall represent an engine with a displacement volume of approximately 1.4 liters.

(5) Lean-Burn Engine:
A lean-burn engine utilizes use of lean air/fuel mixture inside a combustion chamber, which reduces throttling losses. Typically, engine power is managed by partially closing an intake throttle and limiting the amount of air entering a combustion chamber. The additional work done in pumping air through the throttle reduces the engine efficiency. However, if the air/fuel ratio is increased (i.e. lean mixture), lower engine power can be achieved with fueling alone while keeping the throttle at almost wide open all the time. This increases the overall engine efficiency by reducing engine pumping (i.e. throttling) losses. Engines designed for lean-burn can utilize higher compression ratios and provide better performance and efficiency while producing lower levels of hydrocarbon emissions than conventional engines. The major downside of lean-burn engines is the requirement for a complex and expensive exhaust aftertreatment system to reduce NOx emissions. The engine map shall represent an engine with displacement volume of approximately 2.0 to 2.5 liters.

For all engine maps, the contractor shall identify the fuel used during the testing. The contractor shall reformat the data including engine maps, if necessary, according to the format that EPA requires. The format will be communicated with the contactor when the data search begins through written technical direction by the EPA WAM. The vehicle data set shall include the variables defined in Task 1. The engine maps shall include fuel consumption maps, maximum and minimum engine torque curves for each engine in excel file format. The maximum and minimum engine torque curves shall be provided in one-dimensional look-up tables, as function of engine speed alone. The fuel consumption map shall be a two-dimensional look-up table, as function of engine speed and torque.

II. DELIVERABLES

1. Quality Assurance Project Plan (QAPP). The contractor shall submit a draft QAPP to the EPA WAM within 15 days of Work Plan submission. The QAPP shall detail data collection and analysis tasks and procedures for this work assignment. The EPA WAM shall review and comment on the QAPP. A final QAPP shall be submitted within 15 days after receipt of EPA comments.

2. Weekly Progress Reports. The contractor shall provide the EPA WAM with weekly status reports via telephone conference or email during the period of performance. The progress report shall indicate the progress achieved in the concluded weeks, technical problems encountered, solutions to those problems, and projected activity for the upcoming weeks. Before proceeding with any solution to a problem, the contractor shall report the problem and consult with the EPA WAM concerning the scope of the solution. The weekly progress report shall also include an estimate of the percentage of each task completed to date, and the resources (level of effort and cost) expended on each task.

3. Data and Reporting. The contractor shall provide full documentation to the EPA WAM for each set of engine maps and vehicle data. This documentation shall include descriptions of engines and vehicles tested (e.g., engine displacement volume, type of fuel used, etc.) as well as engine maps themselves (e.g., units). The EPA WAM will review and provide comments on a draft version of the documentation. The contractor shall incorporate the EPA WAM's comments in the final version of the documentation. Data and reports shall be delivered in formats specified by the EPA WAM (e.g., Word, Excel).

Delivery Schedule and Milestones

	Milestone/Deliverable	Date
1	Kick-off meeting between EPA and contractor	Within 1 week of receiving Work Assignment
2	QAPP submission	Within 15 days of Work Plan submission
3	Final QAPP submission	Within 10 days of receiving EPA comments
4	Complete Tasks 1 and 2	Before September 30, 2012
5	Delivery of final documentation	Within 1 week of receiving of EPA comments.

NON-DISCLOSURE AGREEMENT

All documentation acquired and/or provided by EPA or generated as a result of this project shall be under the control of the U.S. EPA Assistant Administrator for Air and Radiation, or his or her designated representative, and shall not be released by the Contractor to any other source without specific approval by U.S. EPA.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-16

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-12-011	02/01/2012 To 09/30/2012	Reducing Locomotive Emissions
	Base X Option Period Number	

Contractor	Specify Section and paragraph of Contract SOW
ICF INCORPORATED, L.L.C.	Tasks 5 and 12

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 09/07/2012 To 09/30/2012

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (*Max 2*): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period:	Cost/Fee:	LOE:
02/01/2012 To 09/30/2012		
This Action:		
Total:		

Work Plan / Cost Estimate Approvals

	Cost/Fee:	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Joie Middlebrook (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4934 FAX Number:
Project Officer Name: Greg Janssen (Signature) (Date)	Branch/Mail Code: Phone Number: 734-214-4285 FAX Number: 734-214-4821
Other Agency Official Name: Jose Ortiz (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2831 FAX Number: 513-487-2109
Contracting Official Name: Matthew Growney (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2029 FAX Number: 513-487-2109

Performance Work Statement
Title: Reducing Locomotive Emissions Workshop Facilitation and Report

Contractor: ICF	**Contract No.:** EP-C-12-011
Work Assignment (WA) Number:	0-16
Period of Performance (PoP):	September 6, 2012 – September 30, 2012
Work Assignment Manager (WAM):	Joie Middlebrook 2000 Traverwood Drive Ann Arbor, MI 48105 Phone: 734-214-4934 Email: middlebrook.joie@epa.gov
Alternate WAM	Erik Herzog Phone: 734-214-4487 Email: herzog.erik@epa.gov
Project Officer (PO):	Greg Janssen 2000 Traverwood Drive Ann Arbor, MI 48105 Phone: 734-214-4285 Email: janssen.greg@epa.gov
Contracting Officer (CO):	Sandy Savage 26 West Martin Luther King Drive *Mail Code:* NWD1 Cincinnati, OH 45268 Phone: 513-487-2046 Email: savage.sandra@epa.gov

Although this WA will begin during the base period of the contract, the majority of the work will be performed during Option Period I, which commences October 1, 2012. Information on this Work Assignment is provided to enable the Contractor to prepare a Work plan for both contract periods. Contractor shall provide separate technical and cost proposals for work to be performed during each of the Periods of Performance.

BACKGROUND

On December 7, 2011, President Obama and Canadian Prime Minister Harper announced the Regulatory Cooperation Council (RCC Joint Action Plan. Included in the RCC Joint Action Plan is the Locomotive Emissions Initiative – an initiative for Canada and the U.S. to work together to reduce greenhouse gas (GHG) emissions from locomotives.

As part of this initiative, a workshop will be held with industry experts to discuss technologies and options for reducing GHG emissions from locomotives. A Technology and Infrastructure Scan will form the basis for discussion.

The "**North American Railways and Environmental Innovation: Reducing Locomotive Emissions Workshop**" will be held from October 18-19, 2012 at the University of Illinois in Urbana, IL, following the 2012 Railroad Environmental Conference. The workshop will be hosted by Transport Canada and the Environment Protection Agency with the Railway Association of Canada and American Association of Railroads. Those participating in the workshop will be senior-level industry, government, and non-government officials with technical expertise on rail and environmental innovation.

The workshop will bring together railway industry operators, suppliers, researchers, consultants, and government officials to review and assess current, emerging and advanced technologies and practices that are intended to reduce GHG emissions from railway locomotives and railway operations. Participants will explore the technical, operational, policy, and program options to support innovation, research and development, and the uptake of advanced technologies.

TASKS

Contractor shall provide all deliverables electronically, initially in draft form as detailed in the Tasks below. All materials must be in line with OPA guidelines and all web content shall comply with section 508 and other Office of Public Affairs (OPA) guidelines. The EPA WAM will review all deliverables in draft form and provide revisions and/or comments to the Contractor. The Contractor shall prepare the final deliverables incorporating the EPA WAM's comments.

Contractor personnel shall at all times identify themselves as Contractor employees and shall not present themselves as EPA employees. Furthermore, they shall not represent the views of the U.S. Government, EPA, or its employees. In addition, the Contractor shall not engage in inherently governmental activities, including but not limited to actual determination of EPA policy and preparation of documents on EPA letterhead.

Task 1 – Workshop facilitation and note taking

The Contractor shall facilitate the October 18-19 Locomotive Emissions Reduction workshop in Urbana, IL, including:

- Outline workshop objectives,
- Distribute materials to the participants,
- Oversee break-out sessions,
- Ensure that workshop agenda is followed,
- Encourage open discussion and participation by all attendees,
- Take notes of presentations and discussions,
- Prepare a summary of discussion results,
- Review summarized discussion results for workshop attendees.

The tentative agenda for the workshop is as follows:

Day 1

Welcome/Opening

Objectives outlined by facilitator

Presentation by Transport Canada's contractor re: technology report

Facilitated breakout discussion, (six or so groups, each discuss one topic, in turn, and summarize briefly before groups switch to next topic; by end, all six groups will have cycled through all six topics progressively)
Facilitator to take notes and summarize results 1st day

Day 2
Review summarized results
Facilitated breakout discussion, (same as day 1, working each technology through a criteria "grid" relating to feasibility, challenges, etc).
Facilitator to take notes and prepare draft summary of meeting results post-meeting

EPA WAM will provide the Contractor for the materials which will be distributed and discussed at the workshop.

The Contractor shall teleconference with the EPA WAM at least once every two weeks to clarify details of the workshop facilitation and note taking. If the EPA WAM is unavailable, the Contractor shall contact the EPA Alternate WAM with all issues and statuses.

Task 1 Deliverables	**Date**
Workshop facilitation, note taking, and summarization.	October 18-19

Task 2 – Workshop materials and report
The Contractor shall prepare a report of discussion topics from notes taken during the workshop. The report will highlight major points of discussion and agreed upon technologies and practices to reduce GHG emissions from locomotives.

With the exception of summarized results from the 1st day's breakout discussion results, the Contractor shall provide all deliverables electronically, initially in draft. All materials must be in line with OPA guidelines and all web content shall comply with section 508 and other Office of Public Affairs (OPA) guidelines. The EPA WAM will review all deliverables in draft form and provide revisions and/or comments to the Contractor. The Contractor shall prepare the final deliverables incorporating the EPA WAM's comments.

Task 2 Deliverables	**Date**
Workshop materials and report DRAFT	November 1
Workshop materials and report FINAL	Within one week of receiving WAM comments

Travel

EPA anticipates that two Contractor personnel with attend the two-day workshop in Urbana, IL; one to facilitate and the other to take notes.